92627

RECORD OF DECISION

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

CHEMFAX, INC. SITE

GULFPORT, HARRISON COUNTY, MISSISSIPPI

PREPARED BY

U. S. ENVIRONMENTAL PROTECTION AGENCY

REGION 4

ATLANTA, GEORGIA

DECLARATION OF THE RECORD OF DECISION

SITE NAME AND LOCATION

Chemfax, Inc. Site
Gulfport, Harrison County, Mississippi
EPA ID No. MSD008154486

STATEMENT OF BASIS AND PURPOSE

This decision document presents the Selected Remedy for the Chemfax, Inc. Site, located in Gulfport, Mississippi, which was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. Section 9601 et seq., and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300. This decision is based on the administrative record for the Chemfax, Inc. Site.

The State of Mississippi, as represented by the Mississippi Department of Environmental Quality, has been the support agency during the Remedial Investigation and Feasibility Study (RI/FS) process for the Chemfax, Inc. Site. As such, they have reviewed the documents that comprise the RI/FS and have been involved in the process. The State concurs with the Selected Remedy.

ASSESSMENT OF THE SITE

The response action selected in this Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

DESCRIPTION OF SELECTED REMEDY

This remedial action addresses both the remaining principal threats posed by this Site (site soils and sediments) and the contaminated groundwater beneath the Site. The remedial action for the soils/sediments is excavation and off-site disposal at an approved facility. The remedial action for the groundwater calls for pumping of the groundwater to the surface, where it will be treated by physical and/or chemical means.
The major components of the selected remedy for this remedial action include:

- Excavation of contaminated soils and sediments from those areas exceeding cleanup standards. These soils and sediments constitute the principal threats remaining at the Site.
- Backfilling of the excavated areas with clean soil;
- Off-site disposal, at an approved facility, of the excavated soil and sediment;
- Extraction of the contaminated groundwater to the surface, where it will be treated by physical and/or chemical means, then discharged to surface water;
- Continuation of the groundwater remedial action until the groundwater performance standards are met;
- Designation of a portion of the Site as a Corrective Action Management Unit (CAMU).
- Institutional controls will be placed on the Site to restrict land use while the remedial action takes place.
- Fugitive dust emissions and surface water runoff during the remedial action will be controlled via engineering controls such as water, tarpaulins, or plastic sheeting.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technology, to the maximum extent practicable. The remedy set forth in this document does not satisfy the statutory preference for treatment as a principal element since the principal threats remaining at the Site (soils and sediments) are being disposed off-site without treatment. Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Record of Decision. Additional information can be found in the Administrative Record file for the Site.

- Chemicals of concern (COCs) and their respective concentrations.
- Baseline risk represented by the COCs.
- Cleanup levels established for COCs and the basis for the levels.
- How source materials constituting principal threats will be addressed.
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and the ROD.
- Potential land and groundwater use that will be available at the Site as a result of the Selected Remedy.
- Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected.
- Key factors that led to selecting the remedy.

AUTHORIZING SIGNATURES

Pursuant to Section 104 of CERCLA, the President is authorized to undertake actions in response to a threat or potential threat to human health, welfare, or the environment. This authority was delegated to the Administrator of the U.S. EPA, then to the Regional Administrators, and through other delegations, the Division Directors of the Superfund Program are now authorized to approve these actions.

Winston A. Smith　　　　11-21-02

WINSTON A. SMITH　　　　DATE
DIVISION DIRECTOR
WASTE MANAGEMENT DIVISION
U.S. EPA REGION 4

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RECORD OF DECISION

Chemfax, Inc. Site
Gulfport, Harrison County, Mississippi
EPA ID Number MSD008154486

1.0 SITE LOCATION AND DESCRIPTION

The Chemfax, Inc. Site is located in Gulfport, Harrison County, Mississippi. It occupies 11 acres and is bordered by Three Rivers Road to the east and by Irby Steel and Creosote Road to the south (see Figure 1-1). Located to the north is County Barn Road and Bernard Bayou, and to the west is a rail line and the abandoned Alpine Masonite facility. Emergent and forested wetlands comprise part of the Site, which is located within the southeast quadrant of the interchange where Highway 49 meets Interstate 10. The Site is a former industrial facility.

EPA has been the lead agency at the Site, while the State of Mississippi, as represented by the Mississippi Department of Environmental Quality (MDEQ), has been the support agency during the Remedial Investigation and Feasibility Study (RI/FS) process for the Chemfax, Inc. Site. As such, MDEQ has reviewed the documents that comprise the RI/FS and has been involved in the process. The State concurs with the selected remedy. RI/FS activities have been funded by EPA's Superfund.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Chemfax, Inc. was established in March, 1955 and produced synthetic hydrocarbon resins and waxes from petroleum products. The primary operation at the time business ceased in 1995 was a paraffin blending process in which different grades of paraffin wax were heated together to a liquid state, blended, and then cooled with water. Cooling water was obtained from an on-site industrial well. Historically, condensed cooling water was stored in an on-site holding pond and re-used.

Preliminary Assessment

Chemfax was inspected by EPA in February 1980 and April 1981. The State of Mississippi also investigated Chemfax in December, 1980. In both the state and EPA investigations, it was noted that Chemfax discharged some of its cooling water into the ditch that drains ultimately to the Bernard Bayou.

In May 1982, the Mississippi Division of Solid Waste notified Chemfax that the pond could be drained, residual resin in the pond left in place, and the pond filled with dirt, providing that a minimum of 6 inches of clay was used for a cap. The pond was filled in the early 1980s.

Site Investigations

In July 1981, EPA conducted a sampling investigation at Chemfax. The holding pond sample results showed 0.6 ppm of phenol.

In May 1988, EPA conducted a Screening Site Inspection (SSI) at Chemfax. At the time of this investigation, housekeeping at the facility was found to be generally poor. While on the site, an unknown white liquid was observed leaking from a chemical railroad tanker onto the ground beneath it. Several open 55-gallon drums were stacked on their sides and contained a white, waxy material, and labeled as containing waste paraffin.

The sampling consisted of five surface soil samples, three surface water samples, three sediment samples, and one industrial well sample. Results indicated that a wide range of purgeable, extractable, and miscellaneous organic compounds were present in the samples.

Listing Site Investigation (LSI)

In August 1989, EPA conducted a reconnaissance of off-site areas and an inspection was conducted at the on-site Alpine Masonite facility. It was discovered that Alpine Masonite operated a spray irrigation pond. The pond functioned as a disposal area for process wastewater associated with the manufacture of glues, which were in turn used in the manufacture of Masonite hardboard. Operations at Alpine Masonite were limited to the production of Masonite glues only. Once the glues were produced they were shipped to the manufacturing plant in Laurel, Mississippi. Housekeeping at Alpine Masonite was described by the EPA investigators as excellent.

It was also learned from another employee that Alpine Masonite operated a large lagoon located on the property now occupied by Chemfax. Aerial photographs taken in 1982 revealed a large excavated area located approximately 100 feet north of the main operations building at Chemfax, believed to be the former lagoon.

The primary purpose of the August, 1989 reconnaissance was to evaluate the surface water migration pathway to facilitate the design of Phase I of the Listing Site Inspection (LSI) field investigation. The Phase I LSI, conducted in December 1989, confirmed the surface water pathway using a dye tracer test. Thirteen sediment and three subsurface soil samples were also collected. The Expanded Site Inspection was initiated as a result of the Phase I LSI.

Expanded Site Investigation (ESI)

The ESI consisted of a wide range of activities. Field screening was conducted to aid with sample locations. Sediment, surface soil, subsurface soil, groundwater, and surface water samples were collected. In addition, an air sampling study was performed. Permanent monitoring wells were installed and logged to determine the lithology at the site. Ambient air sampling was also conducted. The results from these ESI activities are summarized in the January, 1996 Remedial Investigation report, which is part of the Administrative Record for the Site.

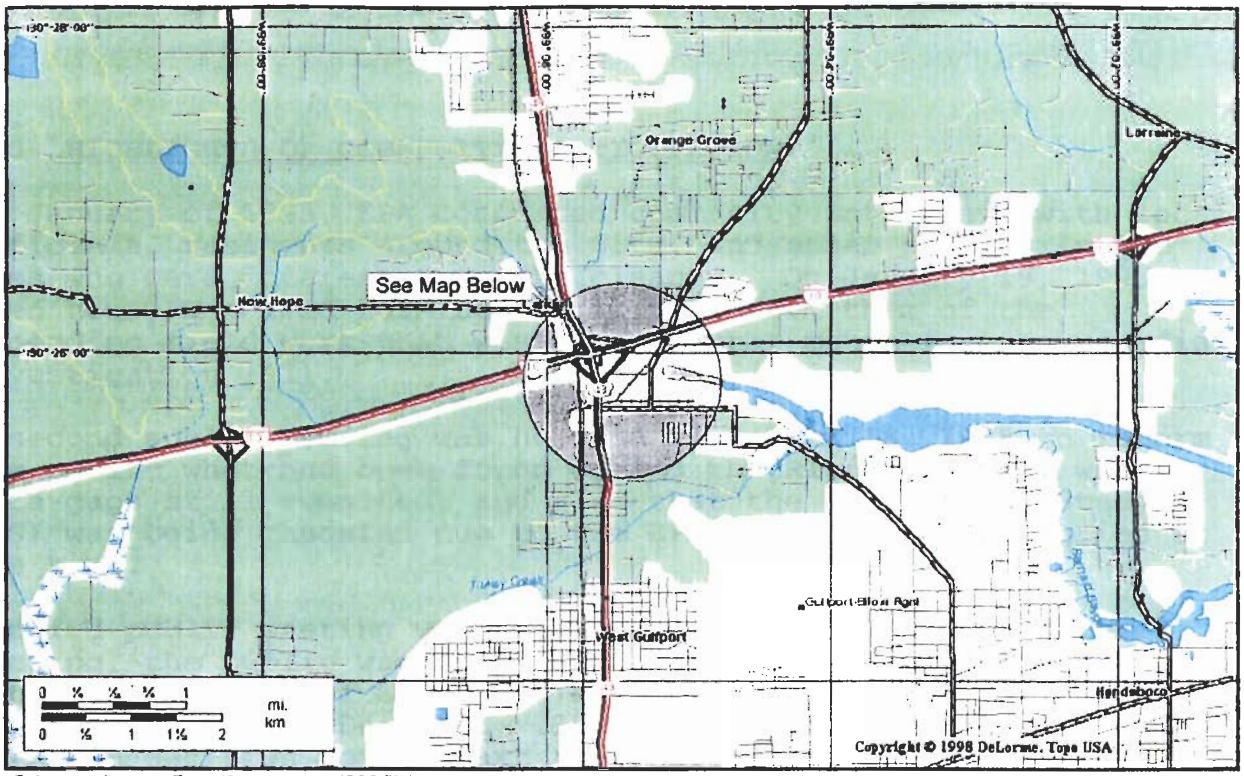
NPL Listing and Removal Action

Due to the contamination documented by the PA, SI, LSI, and ESI activities, the Site was proposed to the National Priorities List (NPL) in May, 1993. At this time, the Site has not been finalized on the NPL.

Field work for the Remedial Investigation (RI) was conducted in-house by EPA in January, 1995. The RI report was finalized in January, 1996, and the Feasibility Study (FS) was finalized in April, 2000. A baseline risk assessment for human health was also included as part of the FS, and was finalized in February, 2000. An Addendum to the FS was finalized on June 7, 2000 which addressed some additional issues not included as part of the April, 2000 document.

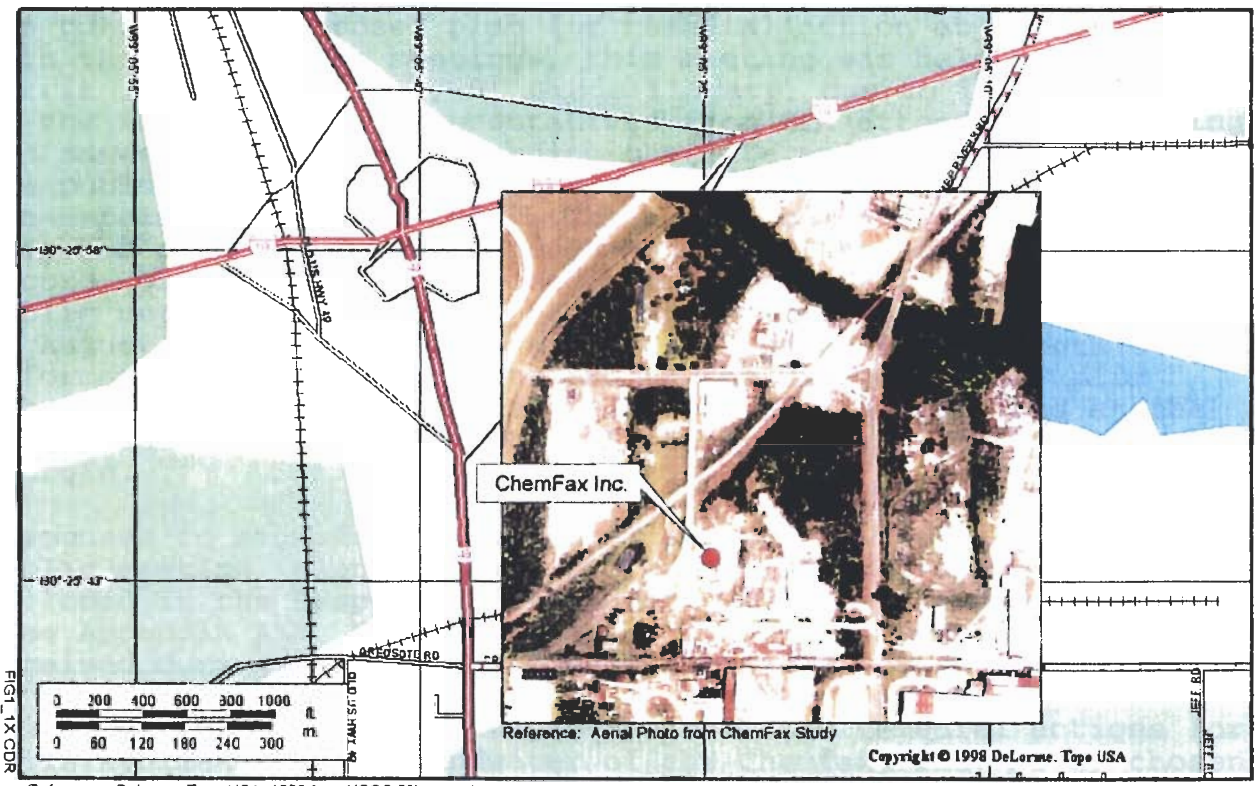
As part of the FS, a site visit was made by EPA in December, 1998. This site visit revealed that the Site was now easily accessible, many drums were stored on-site, and the Site buildings were being lived in by transients. The Site was therefore assessed under Superfund's removal authority, which is intended to address short-term threats to public health and the environment. Based on the available data, a removal action was started in July, 1999 and was completed December, 1999. Several activities were conducted as part of EPA's removal action. Site security was improved in order to limit access to the Site. Asbestos present on remaining equipment was removed and disposed off-site. Drums remaining on-site were removed off-site. Contents remaining in on-site storage tanks were also disposed off-site, in addition to approximately 2000 cubic yards of excavated soils (please see Figure 2-8 in Appendix D). Finally, most of the processing lines, tank farms, bulk storage areas, buildings, and structures were dismantled.

On February 16, 2000, a site visit was made to discuss potential ecological issues at the Site. Representatives from EPA, the State, and the National Oceanic and Atmospheric Administration were present during this site visit.



Reference: DeLorme Topo USA, 1998 from USGS 50' intervals

NORTH



Reference: DeLorme Topo USA, 1998 from USGS 50' intervals

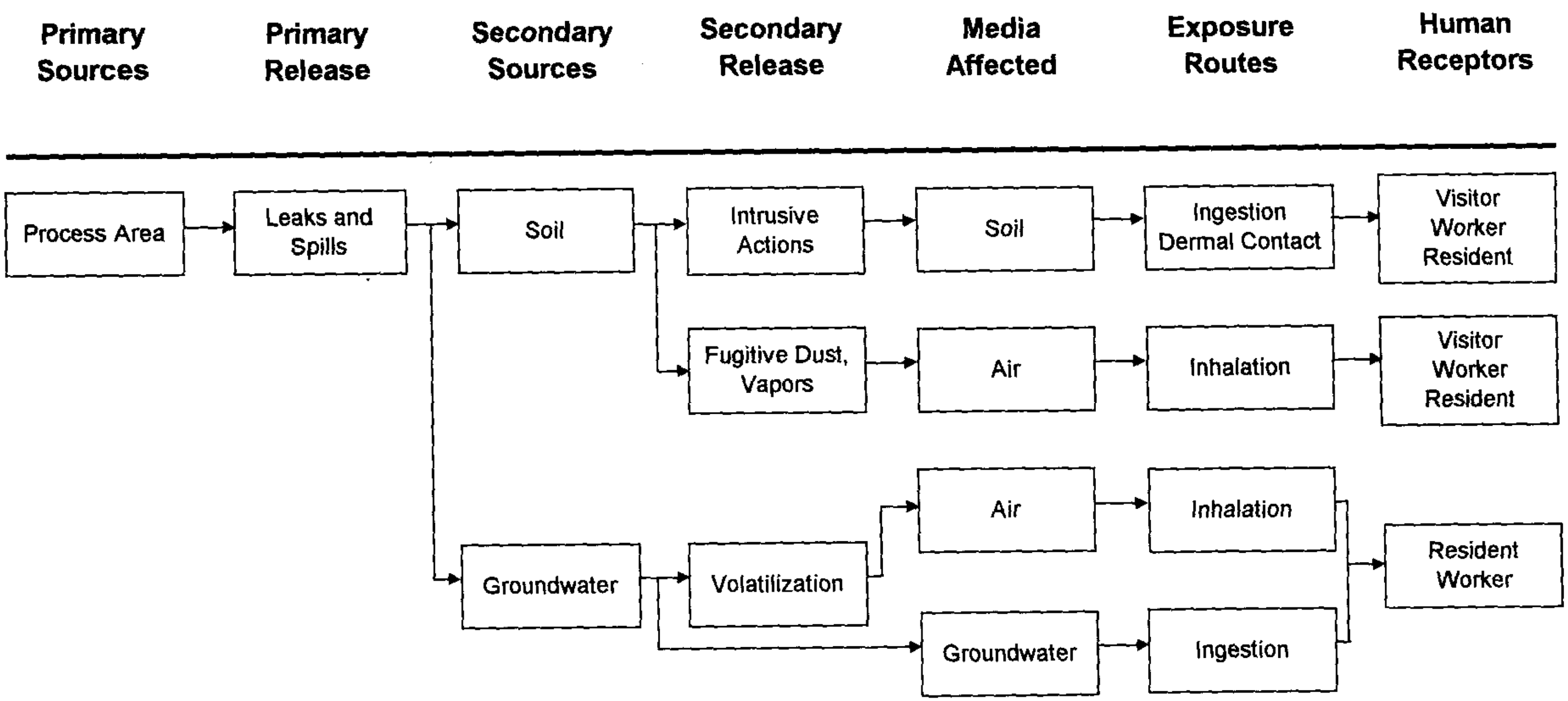
FIG1_1X.CDR

Figure 1-1

EPA

Site Location Map
Supplemental Sampling Investigation
ChemFax, Inc.
Gulfport, Mississippi

Figure 4-3
Conceptual Site Model
Chemfax, Inc. Superfund Site



3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

In January of 1995, EPA conducted community interviews with local officials, residents around the Site, and other parties in the area who were interested in the cleanup. On January 19, 1995 an open house was held for the public to inform them of the impending field work that was planned that month for the Remedial Investigation (RI).

A second public meeting was held on September 18, 1995 to inform the public what had been found during the RI field work, what data gaps still remained, and also that the Feasibility Study (FS) was being canceled due to the EPA's budget uncertainties at the time.

A third public meeting was held on November 16, 1999. At that meeting, the public was informed of the cleanup activity that was conducted as part of Superfund's removal action, which lasted from July, 1999 to December, 1999. The public was also informed of EPA's decision to re-start the Feasibility Study, and what the next steps in the NPL remedial process would be.

On July 20, 2000, a fourth public meeting was held to present to the public the proposed plan for remedial action at the Site. As with the first three meetings, this meeting was held at the Harrison Central School, 9th Grade library, due to its proximity to the Site. Three representatives from EPA attended the meeting and answered questions regarding the Site and the proposed plan. The public notice for this meeting was published in the Biloxi Sun-Herald on July 18, 2000. The public comment period on the proposed plan was July 5 through August 8 (the administrative record, or AR, for the proposed action was not available to the public until July 8, hence the 30 day comment period was extended to August 8). The AR was available to the public, at both the information repository maintained at the Orange Grove Public Library, 12031 Mobile Avenue, Gulfport, Mississippi, and at the EPA Region 4 Library located at 61 Forsyth St., S.W., in Atlanta, Georgia.

Responses to significant comments made during the July 20, 2000 public meeting, along with new relevant information received, are included in the Responsiveness Summary of this decision document (see Appendix A). No other written or oral comments were received during the public comment period.

This decision document presents the selected remedial actions for soils/sediments and groundwater of the Chemfax, Inc. Site, chosen in accordance with CERCLA (as amended) and the NCP. The decision for this Site is based on the administrative record. The requirements under Section 117 of CERCLA/SARA for public & state participation have been met for this Site.

4.0 SCOPE AND ROLE OF ACTION

In 1999, EPA conducted a removal action at this site that resulted in approximately 2000 tons of contaminated soils being removed off-site. The purpose of that removal action was to address imminent threats posed by the site. Although the remedial action set forth by this document may address many of the same areas as the removal action, the purpose of this remedial action is to address long-term threats posed by the site to human health and the environment.

Data obtained during both the 1995 Remedial Investigation and the 1999 Supplemental Groundwater Investigation indicate that the groundwater within the unconfined surficial aquifer at the Site is contaminated. The surficial groundwater at the Site is considered a current or potential source of drinking water. Data from the RI indicate that contaminated site soils and sediments are contaminated at levels which could cause groundwater contamination in the future.

The remedial action described in this decision document encompasses the remediation of both the contaminated soils/sediments and groundwater associated with the Site. Thus, this will be the only operable unit set up for the Site. Following verification monitoring that groundwater performance standards have been reached, the groundwater pumping system will be shut down; additional sampling will also be conducted after equilibrium has been reached in the sub-surface, to confirm that performance standards can be maintained under natural conditions.

5.0 SUMMARY OF SITE CHARACTERISTICS

This section discusses the local geology at the Site in addition to the surface water in the area. The work done to characterize the contamination at the Site is then discussed. A Conceptual Site Model is shown on the next page, which shows the completed exposure pathways for human receptors at the Site, all of which are a result of contaminated soil and groundwater.

5.1 HYDROGEOLOGY/SOILS

Geologic formations of interest in the Site area begin with surficial deposits overlying the Citronelle Formation and descend through the Graham Ferry Formation and Miocene Aquifer System. These are the formations in which the major aquifers in this area of southern Mississippi are found. The Citronelle Formation, in combination with overlying coastal deposits of sand and gravel, serves as the surficial aquifer in the Gulfport area. The Citronelle Formation is composed of quartz sand, chert gravel and lenses, and layers of clay. The thickness of these unconsolidated deposits in this area is approximately 100 feet. Recharge to the aquifer, resulting primarily from rain falling directly on the land surface, is rapid.

Water levels in the Gulfport area are generally less than 10 feet below land surface (bls). The saturated thickness of the Citronelle aquifer ranges from 20 to 103 feet. Although the Citronelle aquifer is considered to be one of the highest-yielding aquifers in Mississippi, it is used little, if any, for domestic water supply in the Gulfport area. Underlying the Citronelle Formation is a clay confining unit thought to be continuous in the Gulfport area.

The Graham Ferry Formation underlies the Citronelle Formation and contains one of the most highly productive aquifers in the Gulfport area. Depth to the Graham Ferry Aquifer is generally greater than 100 feet. Other major water-bearing formations include, in descending order, the Pascagoula, Hattiesburg, and Catahoula Formations of the Miocene Aquifer System. These three aquifers are all of Miocene age and consist of thick beds of sand or gravel separated by clay layers. The Pascagoula Formation, the uppermost of the Miocene age aquifers, is often grouped with the Graham Ferry Formation aquifer since they are practically indistinguishable. It is one of the most productive aquifers in Harrison County, having yields up to 3,000 gallons per minute. The bottom of freshwater occurrence in Harrison County is about 2,200 feet below mean sea level, and the potentiometric surface of the Miocene age aquifers has been observed to be 100 feet bls in Gulfport.

Figure 2-8 shows the groundwater elevations and the associated groundwater flow directions.

5.2 SURFACE WATER AND SEDIMENTS

Chemfax is located approximately 700 feet south of Bernard Bayou in a relatively flat area having a 2 percent slope over most of the property. Surface runoff from the Site migrates generally northward across this slope and is conveyed in one major ditch or stream, which is fed by several tributary ditches and streams. The major stream flows north across the Site along the eastern area of the Alpine Masonite site and turns northeast. Its path more or less follows, and is directed by, the south side of the railroad tracks which runs along the the northern edge of the Site. It leaves the Site near the intersection of County Barn Road and Three Rivers Road. From this point, all surface water drainage flows into a storm drain system located on the west side of Three Rivers Road and is routed directly north to the Bernard Bayou.

There are two tributary waterways on-site which intersect with the primary drainage. One flows north, draining a wet area immediately to the east of the former lagoon area. The other drains the northeast part of Alpine Masonite at the northern boundary of the property, turns northeast, and flows into the most downstream holding pond (North, or Lower, Holding Pond), located in the primary ditch. Figure 3-1 shows these site-related drainage features. Also shown on Figure 3-1 is the Upper Holding Pond, which was excavated during the EPA's 1999 removal action.

Bernard Bayou flows east-southeast from the Site for 2.2 miles, where the water can flow into a canal and travel 3 miles east before entering Big Lake, or continue to flow through Bernard Bayou for 6.4 miles to the east-southeast before also entering Big Lake. Big Lake flows 1.5 miles east before entering Back Bay of Biloxi. Back Bay of Biloxi flows east for the remaining distance of the 15-mile pathway. The surface water pathway from the point of discharge into Bernard Bayou is heavily influenced by tidal fluctuations.

Although no known surface water intakes are present along the migration pathway, recreational fishing, boating, and swimming take place in this area. There are also sensitive environments along the surface water pathway; the closest are approximately 2 miles away and consist of wetland areas along Bernard Bayou, Big Lake, and the Back Bay of Biloxi. Numerous other areas of wetlands exist within the 4-mile radius. The Atlantic sturgeon (Acipenser oxyrhynchus desotoi) and the red cockaded woodpecker (Picoides borealis) are both designated as federally endangered and are found in the area. Eastern oysters (Crassostrea virginica) and Carolina lilaeopsis (Lilaeopsis carolinenesis) also lie along the surface water pathway.

5.3 NATURE AND EXTENT OF CONTAMINATION

The field work involved in characterizing the contamination at this Site was done in-house by EPA personnel, and was conducted in two phases: the first was conducted in January, 1995, and the results were discussed in the *Final Report for the In-House Remedial Investigation at the Chemfax, Inc. Superfund Site*, dated January, 1996. The 1995 work consisted of sampling across several media: surface water, sediment, soils, and groundwater. The second phase was conducted in March, 1999, and the results of that investigation are discussed in the *Supplemental Groundwater Characterization Report*, dated March, 1999. The 1999 work consisted of groundwater sampling only. These investigations were conducted before the EPA removal action was performed in 1999.

None of the contaminated media at the Site are anticipated to meet the RCRA criteria for a hazardous waste.

5.3.1 GROUNDWATER

5.3.1.1 JANUARY, 1995 REMEDIAL INVESTIGATION

A groundwater monitoring system has been installed at the site, Sixteen monitoring wells were sampled during the January, 1995 field work.

In addition, there were three temporary well locations sampled in 1995. During this sampling event, several temporary well locations were unsuccessful in retrieving a groundwater sample, due to the temporary well equipment plugging with mud. This problem was alleviated in 1999 with improved equipment (see Section 5.3.1.2). These locations provided water quality data for shallow (i.e., <25-feet total depth) and deep (i.e., 25- to 50-feet total depth) zones within the surficial aquifer.

The 1995 data showed that volatile organic compounds (VOCs) were detected at elevated concentrations, in the shallow groundwater, at two well locations: MW-02A and MW-05A. The benzene concentrations detected in these two wells were 600 parts per billion (ppb) and 21 ppb, respectively. Benzene was also detected in the sample from temporary well TW-033 (see Figure 4-24 in Appendix D) at a concentration of 63 ppb.

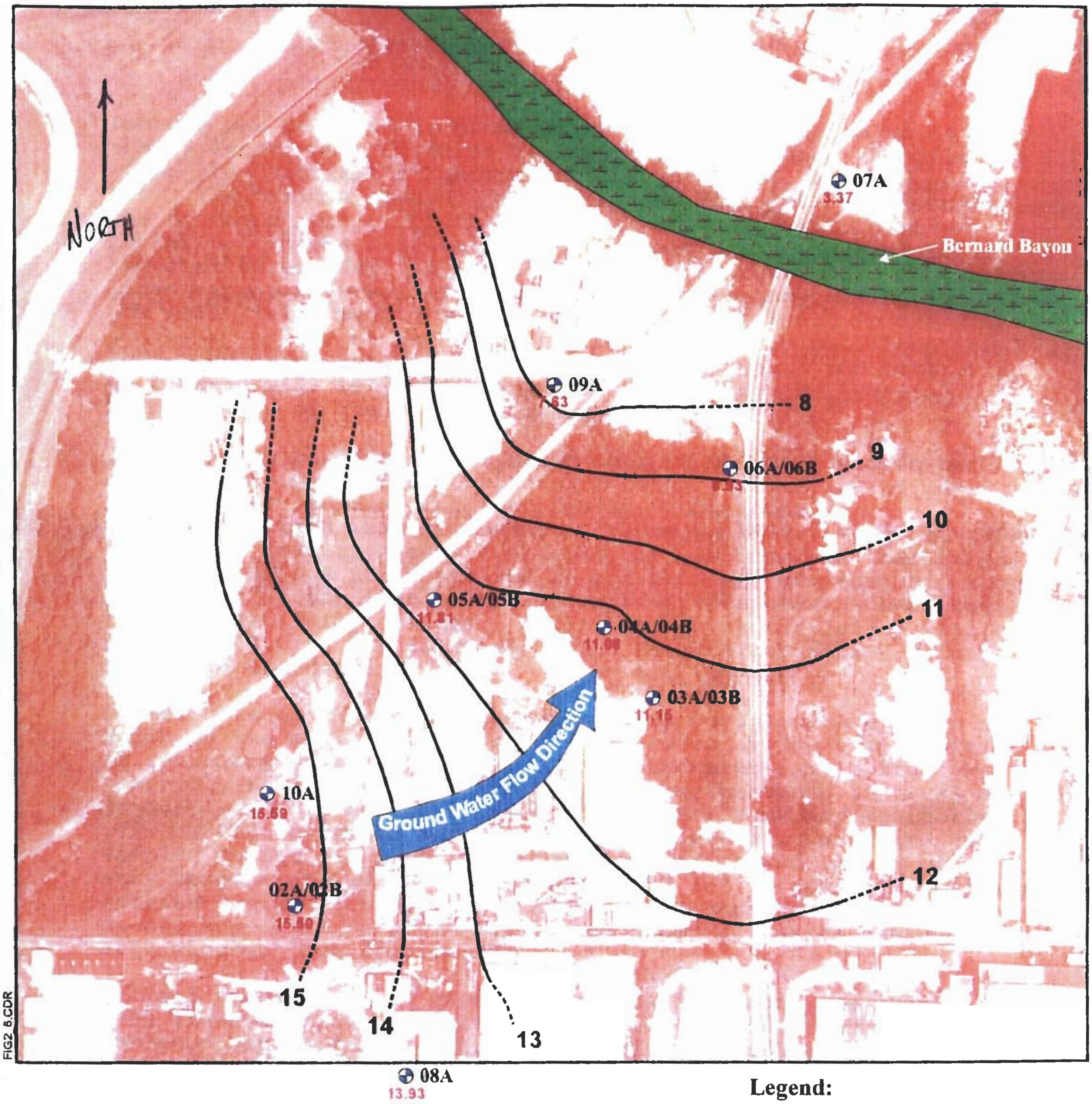
The January, 1996 RI report discussing the January, 1995 investigation stated that no VOC contamination of significance was identified in samples from the deep wells. However, monitoring well MW-02B did detect 4 VOCs at levels that were flagged JN by the laboratory. The compounds found were methyl(methylethyl)benzene (7JN ppb), (methylpropenyl)benzene (20JN ppb), propylbenzene (10JN ppb), and trimethylbenzene (30JN ppb). Please refer also to Section 5.3.1.2. Drinking water standards have not been set for these compounds.

It was noted in the *Final Report for the In-House Remedial Investigation at the Chemfax, Inc. Superfund Site*, that additional work was needed to characterize the groundwater contamination. That work was done as part of the 1999 Supplemental Investigation, discussed below.

Table 1 highlights the groundwater data from both the 1995 and 1999 investigations. Table 1A shows the construction details and screened depths for the permanent monitoring wells.

5.3.1.2 MARCH, 1999 SUPPLEMENTAL INVESTIGATION

In March, 1999, further groundwater sampling was performed at the Site, with the work again done in-house by EPA (as was the January, 1995 work). All of the permanent monitoring wells were sampled again. Fifteen temporary wells were also sampled from fourteen locations in March, 1999 (a sixteenth temporary well, at location 9, was analyzed only with the on-site mobile laboratory). Groundwater samples were obtained from the temporary wells in the process area in the southern portion of the Site; this area could not be sampled in 1995. The new data provided a more complete picture of contaminant distribution in the shallow aquifer.



Legend:

Monitoring Well Locations w/ ground water elevations, feet above mean sea level (MSL)

10 ——— Ground water contours, number is feet above MSL

Figure 2-8

Groundwater Flow Direction/Pattern
Shallow Surficial Aquifer
Supplemental Sampling Investigation
ChemFax, Inc.
Gulfport, Mississippi

EPA

Benzene was detected in groundwater samples collected at 14 of the 29 locations. Of these 14 samples, 10 exceeded the drinking water standard (EPA's Maximum Contaminant Level, or MCL), of 5 ppb. The maximum benzene concentration, 7100 ppb, was found in the southern portion of the Site, at temporary well location number 6. Figure 2-3 depicts the benzene groundwater plume in the shallow aquifer, as of March, 1999. In Figure 2-3, the dashed lines represent areas of uncertainty in the plume definition. Low well yields made groundwater sampling difficult in the southeast corner of the Site, north of temporary well location 1. The groundwater between temporary well location 1 and monitoring well MW-3A will be investigated further during the Remedial Design phase of the Site's cleanup.

In 1995, the portion of the plume near MW-6A was found to be below the 5 ppb Maximum Contaminant Level (MCL) drinking water standard for benzene; for that reason, additional characterization was not conducted there in 1999. When the 1999 analytical results became available, it was observed that sample from well MW-06A now contained 26 ppb benzene, considerably above the MCL of 5 ppb. The boundary north of this point, therefore, has not been fully defined. Additional characterization will be performed during the Remedial Design to more accurately define the plume boundaries.

Please note on Figure 2-3 that temporary well location 16 is not shown on the map. This location is located at the same position as temporary well location 7. The groundwater sample from temporary well location 16 was taken from the depth interval at 30-34', and did not detect any compounds. However, monitoring well MW-02B, screened across the deeper interval, was also re-sampled during the 1999 investigation, and showed levels of ethylbenzene and xylenes at levels of 1J and 2J ppb, respectively (please see Section 5.3.1.1). Additional characterization of the deeper zone will be performed in the Remedial Design phase of the site cleanup (see Section 12).

Table 1 highlights the groundwater data from both the 1995 and 1999 investigations. Table 1A shows the construction details and screened depths for the permanent monitoring wells.

5.3.2 <u>SOILS</u>

One-hundred and forty-four (144) soil samples were collected from 65 locations during the 1995 Remedial Investigation (RI). Sample locations are shown on Figure 4-1, included in Appendix D.

Each location shown on Figure 4-1 represents a grid from which two soil samples were generally collected: a five-aliquot

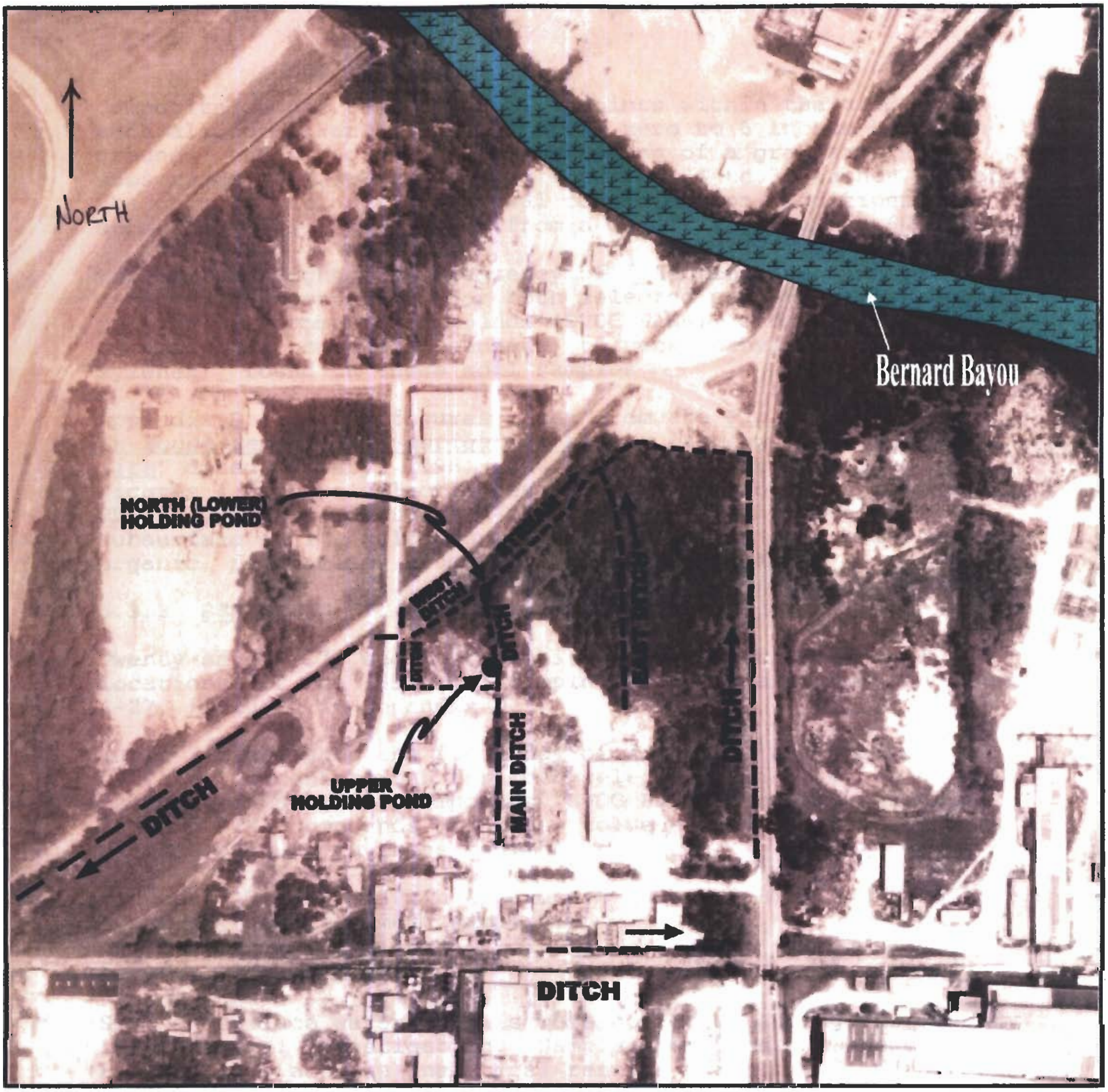


Figure 3-1

On-Site Drainage Features
Chemfax, Inc.
Gulfport, Mississippi

EPA

composite sample taken from five points within the grid (with each aliquot taken from an interval zero to 6 inches below the ground), and a second sample consisting of a grab sample of subsurface soil, taken from an interval 24 to 30 inches beneath the ground. At areas of visual contamination, additional subsurface soils were taken from a deeper interval at 60-66".

Table 2 highlights the frequency of detection and maximum detected concentrations for both selected semi-volatile organic, polynuclear aromatic compounds (SVOC PAHs), and the volatile organic BTEX compounds (benzene, toluene, ethylbenzene, and total xylenes), found in these soil samples.

Appendix D includes figures taken from the *Final Report for the In-House Remedial Investigation at the Chemfax, Inc. Superfund Site*, dated January, 1996, that illustrate the soil findings. Figures 4-2 shows selected results for the inorganic compounds, while Figures 4-3 through 4-23 highlight the surface and subsurface soil results for selected volatile and semi-volatile organic, polynuclear aromatic compounds (PAHs).

5.3.3 SEDIMENTS

Twenty-seven (27) sediment samples were collected from 27 locations for the 1995 RI. Sample locations are shown on Figure 4-27, included in Appendix D.

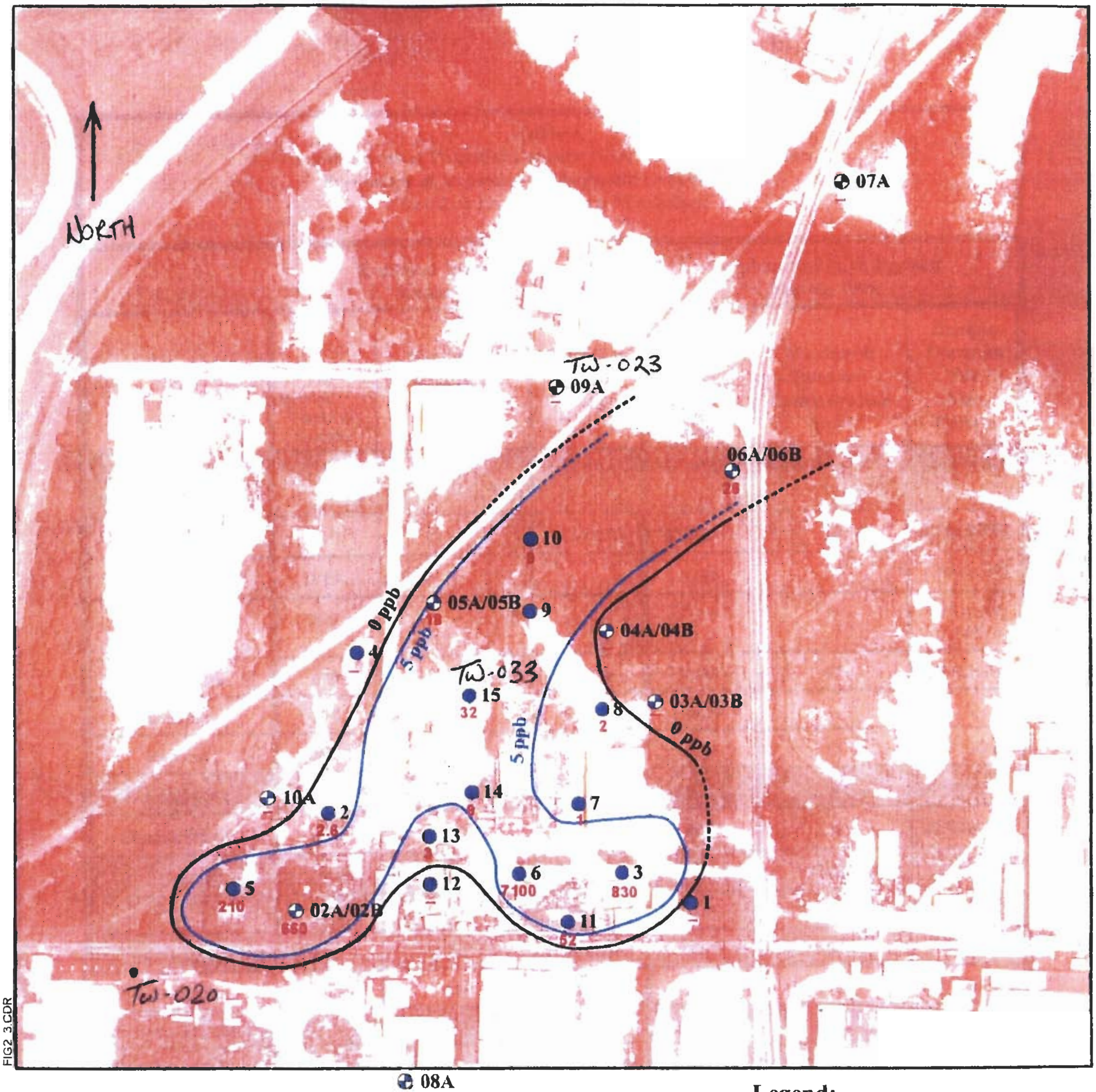
Table 2 highlights the frequency of detection and maximum detected concentrations for both selected semi-volatile organic, polynuclear aromatic compounds (SVOC PAHs), and the volatile organic BTEX compounds (benzene, toluene, ethylbenzene, and total xylenes), found in these sediment samples.

Figures 4-29 and 4-30 in Appendix D show the BTEX and BAPE levels found in these sediment samples.

5.3.4 SURFACE WATER

Sixteen surface water samples were collected during the January, 1995 Remedial Investigation. Sample locations are shown on Figure 4-27, and the analytical results are summarized on Tables 4-19 and 4-20, included in Appendix D.

No identifiable volatile organic compounds were detected in any of the surface water samples. Figure 4-28 in Appendix D shows the one PAH compound detected in one surface water sample.



Legend:

- GeoProbe Location
- Monitoring Well Location
- 0 ppb or non detect boundary
- 5 ppb (MCL) boundary

All concentrations ug/l or ppb
Dashed lines are inferred boundari

NOTE: TW-020, TW-023, AND TW-033 WERE SAMPLED IN 1995 ONLY. THIS MAP REFLECTS THE GROUNDWATER SAMPLES TAKEN IN 1999.

Figure 2-3

Benzene Contamination
Shallow Surficial Aquifer
Supplemental Sampling Investigation
ChemFax, Inc.
Gulfport, Mississippi

Table 1 Contaminants of Potential Concern (COPCs) In Groundwater Frequency of Detection & Maximum Concentrations Chemfax, Inc. - Gulfport, Mississippi						
	Remedial Investigation January, 1995			Supplemental Investigation March, 1999		
Constituent	# of Detects/ Total # of Samples	Maximum Detected Concentration (ppb)	Sample Location For Max Conc'n	# of Detects/ Total # of Samples	Maximum Detected Concentration (ppb)	Sample Location For Max Conc'n
2-methylnaphthalene	1/19	170	CI-05A	5/25	110	CF005GW2
Acenaphthene	1/19	11	CI-05A	5/25	24	CF013GW2
Acenapthylene	0/19	--	--	1/25	2J	CF011GW2
Anthracene	0/19	--	--	1/25	1J	CF5AGW1 (CI-05A)
Dibenzofuran	1/19	2J	CI-05A	3/25	9J	CF012GW2
Fluoranthene	1/19	7J	CI-05A	0/25	--	--
Fluorene	0/19	--	--	5/25	15	CF013GW2
Naphthalene	1/19	630	CI-05A	8/25	2000	CF006GW2
Phenanthrene	1/19	8J	CI-05A	4/25	28	CF012GW2
Benzene	4/19	600	CI-02A	15/29	7100	CF006GW2
Toluene	1/19	54	CI-05A	7/29	640	CF006GW2
Ethylbenzene	2/19	60	CI-05A	13/29	2800	CF006GW2
Total Xylenes	3/19	110	CI-05A	15/29	2800	CF006GW2
Bis(2-chloroethyl)Ether	-	-	-	1/25	38J	CF006GW2
Methyl Butyl Ketone	-	-	-	1/25	460	CF02AGW1

1) Highlighted compounds are Contaminants of Concern.

2) J-qualified data: The presence of a "J" indicated that the mass spectral data passed the identification criteria showing that the constituent was present, but the calculated result was less than the practical quantitation limit (PQL), the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. Although the analytical result is considered to be estimated, J-qualified data were included in the total number of samples with reported concentrations above detection limits.

Table 1A
Monitoring Well Construction Summary
Chemfax, Inc. Superfund Site
Gulfport, Mississippi

Well I.D.	TOC Elevation[1]	Depth[2]	Screened Interval[3]	Material
MW-01A	14.98	25.0	0.02 to -10.02	2-inch SS
MW-01B	15.20	50.0	-24.8 to -34.8	2-inch SS
MW-02A	19.18	25.0	4.18 to -5.82	2-inch SS
MW-02B	19.03	50.0	-20.97 to -30.97	2-inch SS
MW-03A	14.87	25.0	-0.13 to -10.13	2-inch SS
MW-03B	15.54	50.0	-24.46 to -34.46	2-inch SS
MW-04A	13.62	25.0	-1.38 to -11.38	2-inch SS
MW-04B	13.34	50.0	-26.66 to -36.66	2-inch SS
MW-05A	14.91	25.0	-0.09 to -10.09	2-inch SS
MW-05B	15.30	50.0	-24.70 to -34.70	2-inch SS
MW-06A	12.27	25.0	-2.73 to -12.73	2-inch SS
MW-06B	12.24	50.0	-27.76 to -37.76	2-inch SS
MW-07A	13.37	25.0	-1.63 to -11.63	2-inch SS
MW-08A	15.97	25.0	-9.03 to -19.03	2-inch SS
MW-09A	11.63	25.0	-13.37 to -23.37	2-inch SS
MW-10A	16.71	25.0	-8.29 to -18.29	2-inch SS

1 - Elevation in feet above National Geodetic Vertical Datum of 1929 (NGVD29).
2 - Depths are approximate.
3 - Positive numbers are elevation above NGVD. Negative numbers are elevations below NGVD.

The remedy selected for the site cleanup will include additional characterization of the groundwater contaminant plume to evaluate and establish monitoring points for determining whether discharge of the contaminated groundwater to Bernard Bayou will occur at levels of potential human or environmental risk.

5.3.5 **SURFACE WATER PATHWAY ECOLOGICAL EVALUATION**

An ecological evaluation of surface water and sediment in drainage pathways, including on-site streams and ditches and off-site in Bernard Bayou was conducted by the Ecological Support Branch, Athens, Georgia, in 1995 ("*Preliminary Ecological Evaluation of Surface Water Drainages at the Chemfax Superfund Site, revised December 1995*", which was included as Appendix B of the January, 1996 Remedial Investigation report). Investigated were eight stations: five were located on-site; two were located on Bernard Bayou (upstream and downstream of the site); and one was located off-site as a reference station.

The investigation identified limited toxic effects. Although some toxic effects were observed in some tests, there was no significant mortality observed in the *Ceriodaphnia* 7-day survival/reproduction test using surface water in any of the samples. Also, none of the surface water samples were toxic to Microtox bacteria. Last, none of the stations proved toxic to the *Selenastrum capricornutum* 96 hour growth test, except one station, Station 217.

No toxic effects were observed in samples collected from Bernard Bayou.

With respect to the five on-site sample locations, four appeared to exhibit toxic effects. The three sediment samples, however, were statistically significant based on the endpoint of a decrease in the number of young born, while the biological effects were questionable. Surface water from the fourth location caused some toxic effects, however, this sample did not have any site-specific chemicals of concern.

5.3.6 **SOILS/SEDIMENTS AREAS OF CONCERN**

Contaminated soils and sediments were evaluated with respect to the cleanup standards calculated for the protection of groundwater (see Section 9.2). The potential excavation volume was then calculated by summing the surface and subsurface soils that exceeded these cleanup standards (or performance standards). The Addendum to the FS, dated June, 2000, page 11, discusses those locations that exceeded the performance standards, and calculated an estimated soil volume of 14,900 cubic yards requiring excavation. Estimated excavation depths would range from one to six feet.

Figure 2-13, included in Appendix D, shows those soil areas potentially requiring excavation. Figure 2-13 is based on soil screening levels since the performance standards had not been finalized as of April, 2000; however, it is included here since it helps show the predominant areas of soil contamination.

6.0 <u>CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES</u>

The site is currently unused. However, the Mississippi Department of Transportation has indicated its desire to locate a rail spur across part of the site, in order to eliminate one of the two aging rail crossings at Highway 49.

Based on past and anticipated future use of this Site, and current zoning for the Site and the property adjacent to the site, a commercial land use is the most appropriate potential future use for this Site. The Site and adjoining properties are commercially zoned. Under this classification, various industries are permitted including light industrial operations, etc.

Typically, EPA expects that the vast majority of sites with current commercial uses will continue to be used as commercial or industrial sites. Future commercial land use is likely to be a reasonable assumption where a site such as this one is currently used for commercial purposes, is located in an area where the surroundings are zoned for commercial use, and the property is expected to continue to be used for commercial purposes.

In cases where a remedy is designed to be protective for a future commercial land use, it is normally necessary to include institutional controls to ensure that the future land use is restricted to a non-residential land use. However, the remedy set forth in this decision document will not include future institutional controls since the Site soils do not pose an unacceptable risk to the lifetime resident, and the groundwater will be cleaned up to levels protective for a residential land use.

Although currently unused in the area, the surficial groundwater at the Site is considered Class II, i.e., a current or potential source of drinking water. The performance standards for Class II groundwater are MCL's and non-zero MCLG's. Data from the RI indicates that soils and sediments are present on-site which could cause groundwater contamination in the future due to rainfall infiltration and leaching of contaminants to groundwater.

Table 2 Contaminants of Potential Concern in Soils and Sediments Frequency of Detection and Maximum Concentrations *Chemfax, Inc. - Gulfport, Mississippi - Remedial Investigation - January, 1995*						
	SOILS			SEDIMENTS		
Constituent	**# of Detects/ Total # of Samples**	**Maximum Detected Concentration (ppb)**	**Sample Location For Max Conc'n**	**# of Detects/ Total # of Samples**	**Maximum Detected Concentration (ppb)**	**Sample Location For Max Conc'n**
2-methylnaphthalene	56/144	320,000	155-SLB	10/27	800,000	235
Acenaphthene	18/144	42,000J	163-SLB	11/27	120,000J	235
Anthracene	11/144	2000	158-SLC	9/27	47,000J	235
Benzo(a)anthracene	12/144	3700	109	11/27	5200J	203
Benzo(a)pyrene	10/144	1800	109	8/27	4200	220
Benzo(b and/or k) fluoranthene	22/144	2000	109	6/27	16,000	220
Benzo(g,h,i)perylene	0/144	--	--	1/27	220J	211
Chrysene	30/144	28,000J	163-SLB	14/27	6400J	203
Dibenzo (a,h) anthracene	0/144	--	--	1/27	1100J	220
Dibenzofuran	1/144	51J	101	0/27	--	--
Fluoranthene	37/144	2800	109	15/27	38,000J	235
Fluorene	5/144	4000J	142-SLB	3/27	110,000J	235
Indeno(1,2,3-cd) pyrene	1/144	300J	109	5/27	2600J	220
Naphthalene	68/144	410,000	146-SLB	13/27	4,500,000	235
Phenanthrene	59/144	110,000J	163-SLB	18/27	330,000	235
Pyrene	44/144	6400	109	19/27	63,000J	235
Benzene	7/144	5400	142-SLB	1/27	15J	203
Toluene	8/144	42,000	142-SLB	1/27	3J	202
Ethylbenzene	16/144	110,000	146-SLB	3/27	39,000J	235
Total Xylenes	17/144	280,000	146-SLB	4/27	64,000J	235
Total PAHs	79/144	790,000	163-SLB	20/27	6,008,000	235

1) Highlighted compounds are Contaminants of Concern.

2) J-qualified data: The presence of a "J" indicated that the mass spectral data passed the identification criteria showing that the constituent was present, but the calculated result was less than the practical quantitation limit (PQL), the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. Although the analytical result is considered to be estimated, J-qualified data were included in the total number of samples with reported concentrations above detection limits.

7.0 SUMMARY OF SITE RISKS

Contaminated groundwater is a major risk at the Site. Installation of drinking water wells and ingestion of groundwater could result in exposure to various contaminants. Information collected during the 1995 and 1999 sampling investigations indicates that hazardous substances released from the Site have contaminated the groundwater beneath the Site. Primary contaminants of concern are polynuclear aromatic hydrocarbons (PAHs) and the BTEX compounds benzene, toluene, ethylbenzene, and xylenes. The discharge of contaminated groundwater to Bernard Bayou is also a potential concern.

Soil and sediment contamination has also been documented on-site, as shown by the 1995 Remedial Investigation data. As with the groundwater, the primary contaminants of concern are PAHs and BTEX compounds.

The remedy that has been selected for this Site will address the risk posed to the public health and the environment by treating the contaminated groundwater on-site, whereas contaminated soils and sediments will be remediated to prevent future groundwater contamination due to rainfall and leaching of contaminants to groundwater.

The analytical data collected in 1995 shows that the soil and sediment contamination documented at this Site does not extend far enough to impact Bernard Bayou. Additional characterization of the groundwater contaminant plume will be performed to evaluate and establish monitoring points for determining that discharge of contaminated groundwater to Bernard Bayou will not pose a future risk to the public health or the environment.

7.1 CONTAMINANTS OF CONCERN (COCs)

Tables 1 and 2 highlight the contaminants that were detected in groundwater, soils, and sediments during the 1995 and 1999 investigations conducted at the Site. Benzene and ethylbenzene were found in groundwater above their drinking water standards set forth under the Safe Drinking Water Act, whereas the other Contaminants of Concern (COCs) shown on Table 1 exceed risk-based standards set for these compounds. Table 2 highlights four COCs with soil/sediment levels exceeding those necessary to protect groundwater from contaminated leachate.

Since Site soils do not pose an unacceptable risk to the lifetime resident, there are no soils COCs based on the inhalation, ingestion and dermal contact exposure routes.

EPA also finalized an FS Addendum document, dated June 7, 2000. This document included the calculation of soil levels that would be protective of groundwater. These soil action levels are based on the prevention of soil leachate migration into groundwater which would cause their groundwater performance standard to be exceeded. There were four compounds that were found to exceed their calculated performance standards (see Section 12.2) for protection of groundwater. The four compounds are naphthalene, benzene, ethylbenzene, and xylenes. These compounds are highlighted on Table 2 on page 16.

7.2 EXPOSURE ASSESSMENT

Whether a chemical is actually a concern to human health and the environment depends upon the likelihood of exposure (i.e. whether the exposure pathway is currently complete or could be complete in the future). A complete exposure pathway (a sequence of events leading to contact with a chemical) is defined by the following four elements:

- a source and mechanism of release from the source,
- a transport medium (e.g., surface water, air) and mechanisms of migration through the medium,
- the presence or potential presence of a receptor at the exposure point, and
- a route of exposure (ingestion, inhalation, dermal absorption).

An evaluation was undertaken of all potential exposure pathways (Table 3) which could connect chemical sources at the Site with potential receptors. All possible pathways were first hypothesized and evaluated for completeness using the above criteria. The current pathways represent exposure pathways which could exist under current Site conditions while the future pathways represent exposure pathways which could exist, in the future, if the current exposure conditions change. Human exposure by each of these pathways was mathematically modeled using generally conservative assumptions, and are evaluated in the Baseline Risk Assessment - Human Health (BRA-HH), dated February 2000. This document is part of the Administrative Record for the Site.

The exposure point concentrations (EPCs) for each of the chemicals of concern and the exposure assumptions for each pathway with an unacceptable risk or hazard were used to estimate the chronic daily intakes for the potentially complete pathways (the exposure assumptions for the pathways of concern are found in Appendix C). The EPCs are summarized here in Table 4 for the shallow groundwater exposure pathway, for those Contaminants of Concern (COCs) that were found to present a significant potential risk. The baseline risk assessment is based on the EPCs that may be encountered during the various Site use scenarios. The EPCs are either the calculated 95% Upper Confidence Limit (UCL) of the arithmetic mean or the maximum concentration detected during sampling or the arithmetic mean of the normal data. EPCs in groundwater are usually the mean chemical concentration in those wells that represent the center of the plume or the most highly contaminated portion of the plume. The intent of the Reasonable Maximum Exposure (RME) is to estimate a conservative exposure case (i.e., well above the average case) that is still within the range of possible exposures. If the calculated UCL exceeded the

TABLE 3
POTENTIAL EXPOSURE PATHWAYS

Media	Scenario	Receptor	Exposure Pathways
Groundwater	Future	Resident Worker	Ingestion/Inhalation Ingestion
Surface Soil	Current/Future Future	Trespasser/Visitor Resident Worker	Ingestion, Inhalation & Dermal Contact Ingestion, Inhalation & Dermal Contact Ingestion, Inhalation & Dermal Contact
Surface Water	Current/Future	Trespasser/Visitor	Ingestion & Dermal Contact

maximum level measured at the Site, then the maximum concentration detected was used to represent the EPC. The chronic daily intakes were then used in conjunction with cancer slope factors and noncarcinogenic reference doses to evaluate risk.

7.3 TOXICITY ASSESSMENT

Toxicity values are used in conjunction with the results of the exposure assessment to characterize Site risk. EPA has developed critical toxicity values for carcinogens and noncarcinogens. Cancer slope factors (CSFs) have been developed for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CSFs, which are expressed in units of $(mg/kg/day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg/day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CSF. Use of this conservative approach makes underestimation of the actual cancer risk highly unlikely. CSFs are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied. Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg/day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from

TABLE 4
EXPOSURE POINT CONCENTRATIONS IN SHALLOW GROUNDWATER

Contaminant	EPC Value (ug/L)	Max. or 95% UCL or Mean
2-methylnaphthalene	46	Mean
Naphthalene	511	Mean
Benzene	1770	Mean
Toluene	395	Mean
Ethylbenzene	1007	Mean
Total Xylenes	1222	Mean
Bis(2-chloroethyl)ether	12	Mean
Methyl Butyl Ketone	158	Mean

environmental media can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

Quantitative dose-response data were compiled from EPA's Integrated Risk Information System (IRIS), Health Effects Assessment Summary Tables (HEAST), and National Center for Environmental Assessment (NCEA).

7.4 RISK CHARACTERIZATION

EPA has completed a formal baseline risk assessment (BRA) for the Site. The BRA for human health (BRA-HH), dated February, 2000, has calculated the current and potential threat to human health in the absence of any remedial action. Tables from this BRA-HH are included in Appendix C of this document.

Human health risks are characterized for potential carcinogenic and noncarcinogenic effects by combining exposure and toxicity information. Excessive lifetime cancer risks are determined by multiplying the estimated daily intake level with the CSF. These risks are probabilities that are generally expressed in scientific notation (e.g., 10E-6). An excess lifetime cancer risk of 10E-6 indicates that, as a plausible upper boundary, an individual has a one in one million additional (above their normal risk) chance of developing cancer as a result of Site-related exposure to a carcinogen over a 70-year lifetime under the assumed specific exposure conditions at a Site.

EPA considers individual excess cancer risks in the range of 10E-6 to 10E-4 as protective; however the 10E-6 risk level is generally used as the point of departure for setting cleanup levels at Superfund sites. The point of departure risk level of 10E-6 expresses EPA's preference for remedial actions that result in risks at the more protective end of the risk range. The health-based risk levels for the Site in its current condition are shown in Table 5.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminants's reference dose). A HQ which exceeds unity (1) indicates that the daily intake from a scenario exceeds the chemical's reference dose. By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. An HI which exceeds unity indicates that there may be a concern for potential health effects resulting from the cumulative exposure to multiple contaminants within a single medium or across media. The HIs for the Site are shown in Table 5.

Using the results of the human exposure assessment and the toxicity information, potential human health risks for each COPC and selected exposure pathway were evaluated. Upper bound excess lifetime cancer risks for carcinogenic chemicals and hazard quotients and hazard index values for noncarcinogenic chemicals were estimated. The upper-bound lifetime excess cancer risks derived in this report can be compared to EPA's target risk range for health protectiveness at Superfund sites of 10E-6 to 10E-4. In addition, the noncarcinogenic hazard indices can be compared to a value of 1 since hazard indices greater than 1 indicate a potential for adverse health effects.

The risk characterization results showed that unacceptable risks to people are associated with the long-term ingestion of contaminated groundwater at the Site.

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

TABLE 5
RISK SUMMARY FOR CURRENT AND FUTURE ON-SITE USE

Receptor	Pathway	Noncarcinogenic Risk (Hazard Index)	Carcinogenic Risk
Future Child Resident	Ingestion, inhalation, & dermal contact with soil	2	-
	Ingestion & inhalation of shallow groundwater	168	-
Future Resident (Child to Adult)	Ingestion, inhalation, & dermal contact with soil	-	2x10E-5
	Ingestion & inhalation of shallow groundwater	-	2x10E-3
Future Adult Worker	Ingestion, inhalation, & dermal contact with soil	0.01	3x10E-6
	Ingestion of shallow groundwater	17	2x10E-4

Table 5 shows that the total carcinogenic risk posed by the Site for the lifetime resident is 2x10E-3, and the HI calculated for the child resident is 169. What the carcinogenic value means statistically is that for every 1000 people exposed to Site surface soils, 2 extra cancers *may* result beyond those expected from all other causes.. Table 5 also shows that the total carcinogenic risk posed by the Site for the on-site worker is 2x10E-4, and an HI calculated for the on-site worker of 17. For the Site worker and lifetime resident, these risks are higher than the risk ranges generally used for Superfund remedial cleanups - that risk range is 10E-6 to 10E-4 for carcinogens, and 0.1<HI<3 for non-carcinogens.

The risks calculated for the Site worker and resident are essentially driven by benzene in the groundwater. The excess carcinogenic risk level due only to exposure to Site surface soils is 2x10E-5 for the lifetime resident, and 3x10E-6 for the Site worker. Likewise, the excess non-carcinogenic risk level due only to exposure to Site surface soils is HI=2 for the child resident, and HI=0.01 for the Site worker. These risks are within the acceptable risk ranges generally used for Superfund remedial cleanps, given above. Thus, no further soil remediation is proposed for this Site based on human exposure to Site soils (rather, the selected remedy is based on protection of the groundwater under the Site).

As noted, the greatest risk posed by the Site is from the groundwater, primarily due to the benzene contamination. The excess lifetime resident cancer risk level due to exposure to the Site groundwater is 2x10E-3 (which is essentially equal to the total risk already cited above). This risk estimate is greater than the acceptable risk range that Superfund uses for remedial cleanups.

The risk estimates just cited are based on current reasonable maximum exposure scenarios, using conservative assumptions about the frequency and duration of an individual's exposure.

7.5 <u>ECOLOGICAL RISK</u>

EPA has completed both a Screening Level Ecological Risk Assessment (SL-ERA) and a Problem Formulation ERA (PF-ERA). The SL-ERA consisted, in part, of the identification of all Chemicals of Potential Concern (COPCs). The PF-ERA was comprised of two documents: the first is the *"Draft Technical Memorandum (Rev. 1), Problem Formulation Step 3A - COPC Refinement"*, dated August 18, 2000. That document identified additional ecological screening values that were used to further screen the COPCs. The second document was a memorandum from Brian Farrier, Remedial Project Manager, to the Chemfax, Inc. file, dated March 14, 2001. That memo provided a rationale for determining that none of the COPCs were considered serious enough to warrant an ecological sampling investigation. Therefore, the BERA was completed with the September 5, 2000 memorandum.

7.6 <u>UNCERTAINTIES</u>

At all stages of the risk assessment, conservative estimates and assumptions were made so as not to underestimate potential risk. Nevertheless, uncertainties and limitations are inherent in the risk assessment process. Some uncertainties bias risk estimates low while others bias risk high. EPA's general approach is to choose conservative but reasonable values for exposure variables so that true risks are unlikely to be higher than risks estimated by the baseline risk assessment. Some of the uncertainties associated with the risk assessment are:

- The estimates of exposure point concentrations of the chemicals of concern probably overstate actual concentrations to which individuals would hypothetically be exposed and therefore, the health risk estimates are very conservative. This uncertainty is likely to overestimate the calculated health risks.

- In addition, no attenuation of the chemicals was considered; however, this may reduce concentrations of chemicals over time. This uncertainty also would lead to an overestimate of health risks if contaminant levels are now lower than those found during the 1995 and 1999 field investigations.

- The assumed exposure pathways evaluated in the risk assessment are conservative in nature and may overstate the actual risk posed by this Site. For example, a lifetime resident is assumed to live on-site for seventy years.

- Summing risks or hazard indices for multiple contaminants ignores the possibility of synergistic or antagonistic activities in the metabolism of the contaminants. This uncertainty could lead to either an overstatement or understatement of actual risk.

The response action selected in this Record of Decision is necessary to protect the public health or or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

8.0 REMEDIAL ACTION OBJECTIVES

The Remedial Action Objectives (RAOs) for the Chemfax, Inc. Site are:

1) control migration and leaching of contaminants in site soils and sediments to groundwater that could result in future groundwater contamination;

2) prevent ingestion of groundwater having concentrations of contaminants in excess of performance standards;

3) control migration and leaching of contaminants from Site soils, sediments, and groundwater to surface water.

To meet the first objective, EPA developed soil performance standards that are intended to prevent the leaching of soil contaminants such that groundwater concentrations would not exceed the performance standards set forth in Section 12.1 of this decision document. Using EPA guidance, hydrogeologic parameters were used to mathematically calculate these cleanup numbers for each contaminant. The equations and results are documented as Attachment A of the Feasibility Study Addendum, dated April 18, 2000.

The second objective will be met by remediating the groundwater to the performance standards shown in Section 12.1, thus restoring the shallow groundwater to drinking water standards.

The third objective will be met by implementing the soil and groundwater remedies described in this decision document, thus ; in addition, engineering controls will be put in place during the soil excavation, to control soil/sediment runoff to Bernard Bayou.

9.0 DESCRIPTION OF ALTERNATIVES FOR SOILS/SEDIMENTS AND GROUNDWATER REMEDIATION

EPA evaluated six alternatives for remediating contaminated Site soils. These Site soils include those on-site sediments located in both non-perennial drainage ditches and in the small holding pond designated North (Lower) Holding Pond on Figure 3-1 (see page 12).

It is noted here that the FS presented two options for Alternatives 3, 4, and 5: an on-site disposal option, and an off-site disposal option. However, these alternatives call for excavation and treatment of the soil. Only the on-site disposal option is presented here for these alternatives, since it is not necessary to use off-site disposal for treated soil.

EPA evaluated five alternatives for remediating the groundwater at the Site.

Costs shown for each alternative assume a discount rate of 7%.

9.1 SOILS/SEDIMENTS ALTERNATIVES

9.1.1 ALTERNATIVE NO. 1 - NO ACTION

Est. Capital Cost: $0
Est. Annual O&M Cost: $6,100
Est. Present Worth Cost: $66,142
Est. Implementation Time: <1 year

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) requires that a No Action alternative be evaluated as part of the screening process, in order to provide a baseline for comparison to other alternatives. Under this alternative, no further actions would be taken to address the soils at the Chemfax, Inc. Site. Costs shown are for monitoring purposes.

9.1.2 ALTERNATIVE NO. 2 - IN-SITU TREATMENT W/ BIODEGRADATION /BIOVENTING

Est. Capital Cost: $291,000
Est. Annual O&M Cost: $2,018,500
Est. Present Worth Cost: $2,304,761
Est. Implementation Time: 1 year

Alternative 2 involves the treatment of soil contaminants through in situ biodegradation and bioventing. Soil normally contains large numbers of diverse microorganisms including bacteria, algae, fungi, protozoa, and actinomycetes. In situ biodegradation involves the enhancement of environmental conditions that facilitate biodegradation by native or exotic soil and sediment microorganisms. Aerobic degradation is normally the most efficient manner by which microorganisms break down contaminants. For surface soils, direct exposure to atmospheric oxygen can provide aerobic conditions for in-situ biodegradation. However, for flooded or poorly drained soils, or subsurface soils, it may not be possible to provide direct exposure to atmospheric oxygen without improving drainage.

Bacteria require a carbon source for cell growth and an energy source to sustain metabolic functions required for growth, as well as nutrients, including nitrogen and phosphorus. Hydrocarbon-degrading bacteria use oxygen to metabolize organic material to yield carbon dioxide and water. To degrade large amounts of petroleum hydrocarbons, a substantial bacterial population is required, which in turn needs sufficient oxygen for both the metabolic process and the growth of the bacterial mass.

Bioventing introduces sufficient airflow to enhance natural biodegradation of the contaminants. Airflow can be achieved by either extracting soil air or injecting atmospheric air. If needed, nutrients, soil conditioning chemicals, and hydrogen peroxide can also be introduced thorough infiltration wells, ditches, or surface soil irrigation.

The components of this alternative include a treatability study to verify and quantify the potential effectiveness of biodegradation on Site contaminants, installation of pumping wells to remove excess fluids (i.e., depress the water table when necessary) or contaminated groundwaters, installation of infiltration wells or ditches and a surface irrigation system to provide sufficient nutrients and water, installation of injection or extraction wells to provide oxygen, and confirmatory sampling.

9.1.3 ALTERNATIVE NO. 3 - EXCAVATION, TREATMENT W/ THERMAL DESORPTION, DEHALOGENATION, ON-SITE DISPOSAL

Est. Capital Cost: $2,122,700
Est. Annual O&M Cost: $235,000
Est. Present Worth Cost: $3,841,131
Est. Implementation Time: <1 year

This alternative involves excavating contaminated surface/subsurface soils and sediments and transporting them to a central area on-site for consolidation and staging. These excavated soils and sediments are estimated to have a volume of 14,900 cubic yards. Depending on the moisture content of the excavated material, de-watering may be required prior to treatment. On-site treatment would be performed and the treated material would be backfilled on-site. Together, thermal desorption and a dehalogenation process [glycolate dehalogenation or base-catalyzed decomposition (BCD)] would create a closed-loop system and would be the main treatment for organic compounds. The final treatment system would depend upon the outcome of treatability testing and would be determined during the remedial design phase.

Preprocessing requirements would include solids separation and sizing. Techniques could include screens, shredders, and grinders. This process would remove any material larger than two inches in diameter so that it could be appropriately dealt with; create a more uniform soil mixture that can be treated more efficiently; and prevent large-diameter material from damaging any components of the treatment system.

The BCD process is a chemical dehalogenation technology developed by EPA's Risk Reduction Engineering Laboratory. BCD is initiated in a medium temperature thermal desorber (MTTD) at temperatures ranging from 600 to 950 °F. Chemicals are added to contaminated soil containing hazardous chlorinated organic compounds. BCD then chemically detoxifies the condensed organic contaminants by removing chlorine from the contaminant and replacing it with hydrogen. Because the chlorinated organics have some volatility, there is a degree of volatilization that takes place in parallel with chemical dechlorination. The result is a clean, inexpensive, permanent remedy where all process residuals (including dehalogenated organics) are recyclable or recoverable.

ETG Environmental, Inc. (ETG) and Separation and Recovery Systems (SRS) developed the SAREX® THERM-O-DETOX® system and combined it with the BCD process chemistry. The combined process begins by mixing an inorganic reagent with the contaminated soil. The mixture is heated in the MTTD unit for about one hour at 650 to 800 °F. Some of the chlorinated contaminants can be decomposed during this step. The remaining organic contaminants are thermally desorbed and removed with the offgas. Clean soil exiting the solid reactor can be returned to the excavated areas. The remaining contaminants from the vapor condensate and residual dust are captured and treated for two to four hours at approximately 650 °F in the BCD liquid tank reactor. The reactor uses reagents to help dechlorinate the remaining organics. The treated residuals are recycled or disposed of using standard, commercially available methods, including solvent reuse and fuel substitution.

A second chemical dehalogenation process is known as glycolate dehalogenation. Glycolate dehalogenation uses a chemical reagent called APEG. APEG consists of two parts: an akali metal hydroxide and polyethylene glycol (or PEG). The process consists of mixing and heating the contaminated soils with the APEG reagent. During heating, the alkali metal hydroxide reacts with the halogen from the contaminant to form a non-toxic salt; and the PEG takes the place of the halogen in the contaminant molecule.

Before full-scale implementation of thermal desorption/BCD could occur, a treatability study would be required to confirm that this alternative would be able to meet the RAOs for the Site. A trial run would be required before full-scale thermal desorption/dehalogenation to determine if on-site treatment by this method would meet the RGOs for the COCs, to determine if it is necessary to include the dehalogenation process, and to optimize the process . In addition, this trial run would demonstrate whether or not an increase in the concentration of metals resulting from soil volume reduction would occur.

Site access would be restricted by the existing fence around the Site (with upgrades, as necessary). Institutional controls may need to be placed on the Site while the remedial action takes place. Water would be used to minimize fugitive dust emissions during soil excavation, transport, and handling. Any stockpiles of material during interim storage would be covered by tarpaulins or plastic sheeting to minimize fugitive dust and run on/runoff emissions. Surface water runoff, fugitive emissions and treated soils would be monitored to ensure that the RAOs were being met, as well as to assess the effectiveness of the remedial action. Excavated areas would be re-vegetated after treatment and re-placement of the excavated material.

9.1.4 ALTERNATIVE NO. 4 - EXCAVATION, ON-SITE TREATMENT W/SOLID PHASE BIOREMEDIATION, ON-SITE DISPOSAL

Est. Capital Cost: $2,048,200
Est. Annual O&M Cost: $235,000
Est. Present Worth Cost: $3,720,068
Est. Implementation Time: 1 year

This alternative involves excavating contaminated surface/subsurface soils and sediments and transporting them to a central area on-site for consolidation and staging. These excavated soils and sediments are estimated to have a volume of 14,900 cubic yards. On-site treatment would be performed and the treated material would be backfilled on-site. Solid phase bio remediation would be the main treatment of the organics. The final treatment system would depend upon the outcome of treatability testing and would be determined during the remedial design phase.

Preprocessing requirements would include solids separation and sizing. Techniques could include screens, shredders, and grinders. This process would remove any material larger than two inches in diameter so that it could be appropriately dealt with; create a more uniform soil mixture that can be treated more efficiently; and prevent large-diameter material from damaging any components of the treatment system.

Solid phase bio remediation encompasses a variety of aerobic biological processes including land treatment units, composting, and soil piles. In all of these processes, the growth of indigenous and introduced microorganisms is encouraged through the addition of soil conditioners, mineral fertilizers, oxygen, and moisture. The goal of the process is to encourage the microorganisms to biodegrade contaminants in the soil to less toxic chemicals or to mineralize the contaminants. Mineralization occurs when the microorganisms are able to degrade the contaminants to carbon dioxide and water. Often, biodegradation and mineralization of contaminants occur naturally in soils without nutrient enhancement. In solid phase bio remediation, materials are added to increase the microbial population and, therefore, increase the rate of biodegradation.

Utilizing solid phase bio remediation at the Chemfax Site would consist of mixing the excavated soil with soil amendments and placing it in an aboveground land treatment unit or forming biopiles that include both a leachate collection system and some form of aeration. Moisture, heat, nutrients, oxygen, and pH would be controlled to enhance biodegradation. This process would be used at the Chemfax Site to treat the organic COCs.

Before full-scale implementation of solid phase bio remediation could occur, a treatability study would be required to confirm that this alternative would be able to meet the RAOs for the Site. Key operating parameters associated with the implementation of this technology would be evaluated. Optimal biodegradation requires an appropriate electron acceptor, microbes that are acclimated to the COCs, and optimal microbial growth conditions. Studies would be necessary to determine if particular strains of acclimated microbes would be necessary, the optimal watering and nutrient addition schedules, and the frequency of aeration through tilling.

Site access would be restricted by the existing fence around the Site (with upgrades, as necessary). Institutional controls may need to be placed on the Site while the remedial action takes place. Water would be used to minimize fugitive dust emissions during soil excavation, transport, and handling. Any stockpiles of material during interim storage would be covered by tarpaulins or plastic sheeting to minimize fugitive dust and run on/runoff emissions. Surface water runoff, fugitive emissions and treated soils would be monitored to ensure that the RAOs were being met, as well as to assess the effectiveness of the remedial action. Excavated areas would be re-vegetated after treatment and re-placement of the excavated material.

9.1.5 ALTERNATIVE NO. 5 - EXCAVATION, ON-SITE TREATMENT W/ GAS-PHASE CHEMICAL REDUCTION

Est. Capital Cost: $9,125,700
Est. Annual O&M Cost: $235,000
Est. Present Worth Cost: $ 15,221,006
Est. Implementation Time: <1 year

This alternative involves excavating contaminated surface/subsurface soils and sediments and transporting them to a central area on-site for consolidation and staging. These excavated soils and sediments are estimated to have a volume of 14,900 cubic yards. On-site treatment would be performed and the treated material would be backfilled on-site. Gas-phase chemical reduction would be the main treatment of the organics. The final treatment system design would depend upon the outcome of treatability testing and would be determined during the remedial design phase.

Preprocessing requirements would include solids separation and sizing. Techniques could include screens, shredders, and grinders. This process would remove any material larger than two inches in diameter so that it could be appropriately dealt with; create a more uniform soil mixture that can be treated more efficiently; and prevent large-diameter material from damaging any components of the treatment system.

The patented Eco Logic International, Inc. process employs a gas-phase reduction reaction of hydrogen with organic and chlorinated organic compounds at elevated temperatures to convert contaminants into a hydrocarbon-rich gas product. After passing through a scrubber, the gas product's primary components are hydrogen, nitrogen, methane, carbon monoxide, water vapor, and other lighter hydrocarbons. Most of this gas re-circulates in the process while excess gas can be compressed and stored or used as supplementary fuel for the system's propane-fired boiler. Soils are handled within a thermal desorption unit (TDU) which is operated in conjunction with the reduction reactor.

The TDU consists of an externally-heated bath of molten tin metal (heated with propane) in a hydrogen gas atmosphere. Contaminated soil is conveyed into the TDU feed hopper, where an auger feeds the soil into the TDU. A screw feeder provides a gas seal between the outside air and the hydrogen atmosphere inside the TDU. The auger's variable speed drive provides feed rate control. Soil inside the TDU floats on top of the molten tin and is heated to 600 °C, vaporizing the water and organic material. Decontaminated soil is removed from the tin bath into a water-filled quench tank. The water in the quench tank provides a gas seal between the TDU's hydrogen atmosphere and the outside air. A scraper mechanism removes desorbed soil from the quench tank for subsequent disposal.

After desorption from the soil, the organic contaminants are carried from the TDU to the gas-phase reduction reactor. The gas-phase reduction reaction takes place within a specially-designed reactor. Separate nozzles inject gaseous atomized waste, steam, and hydrogen into the reactor. As the mixture swirls down between the outer reactor wall and a central ceramic tube, it passes a series of electric glo-bar heaters, raising the temperature to 850 °C. The reduction reactor takes place as the gases enter the ceramic tube through inlets at the bottom of the tube and travel up toward the scrubber. The scrubber removes hydrogen, chloride, heat, water, and particulate matter. Scrubber liquid is treated as RCRA waste or recycled through the system for additional treatment.

This process has proven successful with PAHs. All treated material would be backfilled into the excavated areas on-site.

Before full-scale implementation of gas-phase chemical reduction could occur, a treatability study would be required to confirm that this alternative would be able to meet the RAOs for the Site. A trial run would be required before full-scale gas-phase chemical reduction to determine if on-site treatment by this method would meet the RGOs for the COCs and to optimize the process. In addition, this trial run would demonstrate whether or not an increase in the concentration of metals resulting from soil volume reduction would occur.

Site access would be restricted by the existing fence around the Site (with upgrades, as necessary). Institutional controls may need to be placed on the Site while the remedial action takes place. Water would be used to minimize fugitive dust emissions during soil excavation, transport, and handling. Any stockpiles of material during interim storage would be covered by tarpaulins or plastic sheeting to minimize fugitive dust and run on/runoff emissions. Surface water runoff, fugitive emissions and treated soils would be monitored to ensure that the RAOs were being met, as well as to assess the effectiveness of the remedial action. Excavated areas would be re-vegetated after treatment and re-placement of the excavated material.

9.1.6 ALTERNATIVE NO. 6 - EXCAVATION, OFF-SITE TRANSPORTATION, AND SUBTITLE D DISPOSAL

Est. Capital Cost: $909,000
Est. Annual O&M Cost: $65,000
Est. Present Worth Cost: $1,709,990
Est. Implementation Time: 1 year

This alternative consists of transporting contaminated surface/subsurface soils and sediments off-site to a RCRA secured Subtitle C landfill. These excavated soils and sediments are estimated to have a volume of 14,900 cubic yards. After any required modification of the existing rail spur and installation of a loading ramp on the Chemfax Site, excavation of soils would begin. Off-site shipment of soil in covered "gondola" railcars would be the preferred method of transportation. This alternative will remove from the Site all contaminated soils above performance standards set forth in this document.

Institutional controls may need to be placed on the Site to restrict land use while the remedial action takes place. Water would be used to minimize fugitive dust emissions during soil excavation, transport, and handling. Any stockpiles of material during interim storage would be covered by tarpaulins or plastic sheeting to minimize fugitive dust and run on/runoff emissions. Surface water runoff, fugitive emissions and excavated soils would be monitored to ensure that the RAOs were being met.

After removal of all applicable contaminated soils the Site will be backfilled with clean soil and vegetation planted.

9.2 GROUNDWATER ALTERNATIVES

9.2.1 ALTERNATIVE NO. 1 - NO ACTION

Est. Capital Cost: $0
Est. Annual O&M Cost: $6,100
Est. Present Worth Cost: $66,142
Est. Implementation Time: <1 year

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) requires that a No Action alternative be evaluated as part of the screening process, in order to provide a baseline for comparison to other alternatives. Under this alternative, no further actions would be taken to address the groundwater at the Chemfax, Inc. Site.

9.2.2 ALTERNATIVE NO. 2 - LIMITED ACTION/MONITORED NATURAL ATTENUATION

Est. Capital Cost: $115,000
Est. Annual O&M Cost: $157,700
Est. Present Worth Cost: $533,113
Est. Implementation Time: <1 year

Under the limited action alternative, no action would be taken to remediate contaminated groundwater at the Site, unless a specified period of monitoring indicates that groundwater contaminant levels are not decreasing as a result of natural processes and/or activities undertaken for the remediation of soil. If monitoring indicates that levels are not decreasing sufficiently, a contingency plan could be implemented.

Alternative 2 would essentially serve as a monitored natural attenuation (MNA) alternative. Natural attenuation is not a technology, but at some sites, data gathered during the RI/FS may indicate that physical or biological processes (unassisted by human intervention) may effectively reduce contaminant concentrations such that remedial objectives in the contaminant plume or certain portions of the plume are achieved in a reasonable time frame without active remediation. In some cases, remediation alternatives that combine active remediation (e.g., in source areas) with monitored natural attenuation may be appropriate. Performance monitoring is a critical component of this remediation approach because monitoring is needed to ensure that the remedy is protective and that natural processes are reducing contamination levels as expected.

Alternative 2 would primarily involve implementation of institutional measures to control, limit, and monitor activities on-site. The objectives of institutional controls are to prevent prolonged exposure to contaminant concentrations, control future development, and prevent the installation of wells within the contaminated plume boundary. These objectives would be accomplished by monitoring contaminated media at the Site, and limiting use and access by placing restrictions on all properties within the contaminated plume area. The effectiveness of institutional controls would depend on their continued implementation.

The alternative also would include the continued monitoring of groundwater at the Site, as described under Alternative 1. Public health evaluations would be conducted every five years and would allow EPA to assess the ongoing risks to human health and the environment posed by the Chemfax Site. The evaluations would be based on the data collected from media monitoring.

The evaluation and selection of MNA as a remedy component generally requires the development of a more detailed site conceptual model than normal. However, that additional detail is only pursued if warranted. Historical site information indicates that MNA is not appropriate for the Chemfax, Inc. site since groundwater contaminants have migrated towards, and have the potential to eventually impact, Bernard Bayou.

9.2.3 ALTERNATIVE NO. 3 - PUMP AND TREAT WITH PHYSICAL AND/OR CHEMICAL TREATMENT

Est. Capital Cost: $191,425
Est. Annual O&M Cost: $121,625
Est. Present Worth Cost: $1,732,493
Est. Implementation Time: 30 years

Alternative 3 consists of pumping groundwater from on-site extraction wells, well points, and/or subsurface drains to an on-site wastewater treatment system, and with subsequent discharge to either a POTW, injection wells, or surface water. Pumping may be continuous or pulsed to allow equilibration of contaminants with the groundwater.

One likely treatment possibility for removing organic contaminants from groundwater involves the use of activated carbon. Carbon adsorption is a well-established technology with specific operating parameters for organics removal from groundwater and surface water. Carbon is an excellent adsorbent because of its large surface area which can range from 500 to 2000 m^2/g, and because its diverse surfaces are highly attractive to many different types of contaminants. Activated carbon can be manufactured using a variety of sources, yielding granular or powdered forms.

The process of adsorption takes place in three steps. First, the contaminant molecules leave the air or liquid phase and attach to the external surfaces of the GAC granules. Next, it diffuses into the GAC pore structure. Finally, a physical or chemical bond forms between the contaminant and the internal carbon source. A common reactor configuration for GAC adsorption systems is the fixed-bed system. When treating liquids in a fixed-bed system, the contaminated stream enters the top of the column and flows downward. The GAC adsorbs contaminants as the stream passes through the column and the treated stream (effluent) exits the stream. Once the GAC system has become saturated, the granules can be reactivated, regenerated, or discarded.

A second possibility for groundwater treatment involves air stripping, which is effective for VOCs (BTEX). Air strippers are ex situ devices used to physically transfer VOCs from groundwater, surface water, or wastewater to the air. Contaminants are not destroyed by air stripping. Both the effluent generated during treatment and the off-gas stream may require treatment to meet air emissions and disposal criteria. These treatments may include the use of activated carbon polishing treatment, incineration, or catalytic oxidation.

Traditionally, the most common type of air stripper used a pack tower system where high liquid surface area is created by pumping water over the top of a hollow tower and allowing the influent to trickle over a dumped packing material inside the tower. However, low profile air strippers have gained acceptance over the last few years. In these units, water is allowed to flow along one or more flat, shallow trays. Air is blown through hundreds of holes in the bottom of the trays, generating bubbles which create high-surface area films that allow contaminants to volatilize more rapidly.

9.2.4 ALTERNATIVE NO. 4 - IN-SITU TREATMENT

Est. Capital Cost: $291,000
Est. Annual O&M Cost: $2,018,500
Est. Present Worth Cost: $2,304,761
Est. Implementation Time: 1 year

Alternative 4 Consists of the in-situ treatment of contaminated groundwater. In situ treatment allows the treatment of contaminated groundwater without the need to bring it up to the surface, thereby generally avoiding technical and regulatory considerations related to groundwater effluent discharge requirements.

Air sparging is one possible in-situ treatment that could be used at the Chemfax Site. In air sparging, air is injected into the groundwater via wells. The air moves upward through the groundwater and soil. Volatile contaminants partition into the gas phase and are swept out of the area as the air rises or are removed using a soil vapor extraction system. Air injection wells are generally placed a few feet below the water table to induce lateral spreading of air away from the well. An air sparging system typically uses a network of air sparging well points with overlapping zones of influence. The vapor removal system is usually a blower system designed to create enough vacuum to effectively remove the soil vapors. Discharge of extracted vapors must be in compliance with local air discharge standards. This may require off-gas treatment such as carbon beds or thermal oxidizers.

Another applicable in-situ treatment for the Chemfax Site is bioaugmentation. Bioaugmentation involves the addition of nutrients, oxygen, or bacteria to contaminated media to enhance in situ biodegradation of contaminants. Enzyme Technologies, Inc. has developed a new aerobic bioremediation technology called the Dissolved Oxygen In-situ Treatment (DO IT) System. The system cycles nutrient- and bacteria-enhanced, superoxygenated water through a contaminated zone to degrade contaminants in situ. The DO IT technology extracts contaminated groundwater using downgradient extraction wells. This contaminated water passes through a treatment tank, where it is oxygenated and enhanced with nutrients and bacteria. Next, the water enters a mixing chamber that supersaturates the water with dissolved oxygen. Once the water contains sufficient oxygen, it is reinjected through a set of lateral and vertical upgradient injection points to diffuse the contaminated Site with oxygenated, biologically enhanced water. As oxygen is released from the water, it diffuses upward into the capillary fringe and vadose zone soil, allowing for further biodegradation of contaminants in that area as well. This technology can act as a stand-alone technology or may be integrated with pump-and-treat, air sparging, or vapor extraction technologies.

9.2.5 ALTERNATIVE NO. 5 - PERMEABLE TREATMENT BED

Est. Capital Cost: $562,000
Est. Annual O&M Cost: $179,625
Est. Present Worth Cost: $3,036,849
Est. Implementation Time: 30 years

Alternative 6 consists of the construction of a permeable treatment bed (or treatment wall). Treatment walls involve the construction of permanent, semi-permanent, or replaceable units across the flow path of a contaminant plume. As contaminated groundwater flows through the treatment wall, the contaminants are removed by physical, chemical and/or biological processes. These processes include precipitation, sorption, oxidation/reduction, fixation, or degradation. Because a natural gradient of groundwater flow would be used to carry contaminants through the reaction zone, a treatment wall does not require continuous input of energy. In addition, the treatment wall can degrade or immobilize contaminants in situ without the need to bring them to the surface. Furthermore, technical and regulatory considerations related to effluent discharge requirements are avoided.

Under this alternative, a trench of appropriate width would be excavated to intercept the contaminated strata and backfilled with reactive material.. Potential candidates for a reactive material than can successfully treat organic contamination include a subsurface packing material which provides a large surface area for microbial attachment, where optimal conditions for biodegradation are maintained, and metal-based catalysts to degrade volatile organic compounds.

Additional Site characterization is included under this alternative as additional data is needed to assess the potential applicability of treatment wall technology for the Chemfax Site and involves hydrological, geological, and geochemical descriptions of the Site as well as contaminant properties and distribution.

Construction of a treatment wall at the Chemfax Site may be an effective mechanism to prevent further migration of a contaminant plume. If placed immediately downgradient of a contaminant source, a treatment wall may effectively prevent plume formation.

10.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES FOR SOILS/SEDIMENTS REMEDIATION

This section of the ROD provides the basis for determining which alternative provides the best balance with respect to the statutory balancing criteria in Section 121 of CERCLA and in Section 300.430 of the NCP. The major objective of the April, 2000 Feasibility Study was to develop, screen, and evaluate alternatives for the remediation soil/sediments and groundwater at the Chemfax, Inc. Site. The remedial alternatives selected from the screening process were evaluated using the following nine evaluation criteria:

- Overall protection of human health and the environment.
- Compliance with applicable and/or relevant Federal or State public health or environmental standards (ARARS).
- Long-term effectiveness and permanence.
- Reduction of toxicity, mobility, or volume of hazardous substances or contaminants.
- Short-term effectiveness, or the impacts a remedy might have on the community, workers, or the environment during the course of implementing it.
- Implementability, that is, the administrative or technical capacity to carry out the alternative.
- Cost-effectiveness considering costs for construction, operation and maintenance of the alternative over the life of the project, including additional costs should it fail.
- Acceptance by the State.
- Acceptance by the Community.

The NCP categorizes the nine criteria into three groups:

(1) Threshold Criteria - overall protection of human health and the environment and compliance with ARARs (or invoking a waiver) are threshold criteria that must be satisfied in order for an alternative to be eligible for selection;

(2) Primary Balancing Criteria - long-term effectiveness and permanence; reduction of toxicity, mobility, or volume; short-term effectiveness; implementability, and

cost are primary balancing factors used to weigh major trade-offs among alternative hazardous waste management strategies; and

(3) <u>Modifying Criteria</u> - state and community acceptance are modifying criteria that are formally taken into account after public comment is received on the proposed plan and incorporated in the ROD.

The selected alternative must meet the threshold criteria and comply with all ARARs or be granted a waiver for compliance with ARARs. Any alternative that does not satisfy both of these requirements is not eligible for selection. The Primary Balancing Criteria are the technical criteria upon which the detailed analysis is primarily based. The final two criteria, known as Modifying Criteria, assess the public's and the state agency's acceptance of the alternative. Based on these final two criteria, EPA may modify aspects of a specific alternative.

The following sections provide a summary of the evaluation of alternatives for remediating soils/sediments and groundwater at the Site, for each of the criteria. A comparison is made between each of the alternatives for achievement of a specific criterion.

10.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and considers how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

The No Action alternatives are required by CERCLA as a baseline for which to compare the other alternatives. For both soils/sediments and for groundwater, they are not protective of human health and the environment. Soil and sediment contamination would remain that would continue to leach into and contaminate the shallow groundwater beneath the Site. The contaminated groundwater documented at the Site would possibly be used for drinking water in the future, and would possibly impact Bernard Bayou. Because the No Action alternatives would not be protective of human health and the environment, they are not discussed further for the remaining criteria.

Alternatives 2 through 6, as described for soils/sediments, would each be protective of human health and the environment. Alternatives 3, 4, and 5, as described for groundwater, would each be protective of human health and the environment, whereas Alternative 2 would provide a lesser degree of protection since time would be required to determine if a contingent remedy would be implemented. Alternative 2, for groundwater, will not be discussed further for the remaining criteria.

10.2 COMPLIANCE WITH ARARS

Section 121(d) of CERCLA requires that remedial actions at CERCLA sites attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as ARARS, unless such ARARS are waived under CERCLA section 121(d)(4).

Alternatives 2 through 6, as described for soils/sediments, would each comply with all ARARS. Alternative 6 would comply with RCRA and DOT regulations related to the transport and disposal of the contaminated soils/sediments, some of which may include hazardous waste. Alternatives 3, 4, 5, and 6 would require designation of a portion of the Site as a Corrective Action Management Unit (CAMU), in order to comply with EPA's Resource Conservation and Recovery Act (RCRA) regulations with respect to land disposal restrictions (LDRs). These LDRs would be triggered if the excavated soils were to meet the criteria for hazardous waste, as defined under RCRA.

Alternatives 3, 4, and 5, as described for groundwater, would also comply with all ARARS. These alternatives would satisfy all drinking water standards through treatment. Depending on the discharge method, each of these alternatives would comply with the substantive requirements of the Underground Injection Control program or the NPDES program.

10.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Long- term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once performance standards have been met. This criterion also considers the adequacy and reliability of controls.

Alternatives 2 through 6, as described for soils/sediments, would each provide an effective, permanent remedy over the long-term, and are ranked equally for this criterion. Alternatives 2 through 5 would treat the soils/sediments so that contaminants are either removed or broken down, to levels protective of human health and the environment. Alternative 6 would satisfy this criterion since contaminated soils are removed off-site and replaced with clean soils.

Alternatives 3, 4, and 5, as described for groundwater, would also provide effective, permanent remedies over the long-term, and are ranked equally for this criterion. However, it is noted that Alternative 4 would possibly achieve groundwater performance standards in less than time than Alternatives 3 and 5.

TABLE 6 - DESCRIPTION OF CLEANUP ALTERNATIVES- SOILS/ SEDIMENTS

EPA evaluated six alternatives identified in the Feasibility Study (FS) for remediating contaminated soils and sediments related to the Chemfax, Inc. Site. The following table lists each alternative, along with a short description, total present worth cost, and implementation time required. See Section 4 of the FS for a complete discussion of each alternative.

Alternative and Description	Total Cost $ Thousands	Implementation Time
ALTERNATIVE No. 1 - No Action The National Oil & Hazardous Substances Pollution Contingency Plan (NCP) requires that a No Action alternative be evaluated as part of the screening process, in order to provide a baseline for comparison to other alternatives. Under this alternative, no further actions would be taken to address the soils at the Chemfax, Inc. site.	66	0
ALTERNATIVE No. 2 - In-situ Treatment w/Biodegradation/Bioventing This alternative involves treatment of the soils in-place, without excavation, by biodegradation & bioventing. This is done by enhancing the environmental conditions that help microorganism populations grow & break down contaminants. Bioventing refers to the process of introducing air to the subsurface, so that bacteria can thrive on oxygen.	2,305	1 year
ALTERNATIVE No. 3 -Excavation, Treatment with Thermal Desorption, Dehalogenation, On-Site Disposal This alternative includes excavation of contaminated soils, on-site treatment with low temperature thermal desorption, & on-site replacement of the treated soils. Depending on the moisture & physical characteristics of the soil, dewatering, mixing, & material sizing operations may be necessary prior to treatment. Thermal desorption is a treatment process that involves thermal treatment at temperatures of 650-800 oF.	3,841	<1 year
ALTERNATIVE No. 4 - Excavation, On-Site Treatment with Solid Phase Bioremediation, On-Site Disposal This alternative involves excavating contaminated soils & performing bioremediation on-site. The treated material would then be backfilled on-site, graded, & re-vegetated. Depending on the moisture & physical characteristics of the soil, dewatering, mixing, & material sizing operations may be necessary prior to treatment. The treatment process itself is very similar to Alternative 3, whereby environmental conditions are introduced to optimize the microorganism populations. These microorganisms would then break down the contaminants in the soil.	3,720	1 year
ALTERNATIVE No. 5 - Excavation, On-Site Treatment with Gas-Phase Chemical Reduction, On-Site Disposal This alternative involves excavating contaminated soils & performing gas-phase chemical reduction on-site. The treated material would then be backfilled on-site, graded, & re-vegetated. Depending on the moisture & physical characteristics of the soil, dewatering, mixing, & material sizing operations may be necessary prior to treatment. The treatment process involves introduction of hydrogen to the contaminated soils at an elevated temperature of 600 degrees Fahrenheit. The resulting chemical reactions result in breakdown of the contaminants into a mixture of simpler compounds such as methane, carbon monoxide, & water vapor.	15,221	<1 year
ALTERNATIVE No. 6 - Removal & Off-site Disposal This alternative includes excavation & off-site disposal of impacted soils at a permitted waste facility. Soils would be excavated, hauled to a central on-site location, dewatered (if necessary), & then placed into trucks for off-site transport. If feasible, "gondola" railcars could also be used. Excavated areas would be backfilled & re-vegetated. It is anticipated that much, if not all the contaminated soil, will not require disposal at a hazardous waste facility (Subtitle C disposal). However, this remedy will utilize both Subtitle C & Subtitle D facilities, as necessary. The costs shown above assume disposal at a Subtitle D facility (see the June, 2000 FS Addendum in the AR). Final cost might vary according to how much material requires disposal at a Subtitle C facility.	1,710	1 year

TABLE 7 - DESCRIPTION OF CLEANUP ALTERNATIVES- GROUNDWATER

EPA evaluated five alternatives identified in the Feasibility Study (FS) for remediating contaminated groundwater at the Chemfax, Inc. Site. The following table lists each alternative, along with a short description, total present worth cost, and implementation time required. See Section 4 of the FS for a complete discussion of each alternative.

Alternative and Description	Total Cost $ Thousands	Implementation Time
ALTERNATIVE No. 1 - No Action The National Oil & Hazardous Substances Pollution Contingency Plan (NCP) requires that a No Action alternative be evaluated as part of the screening process, in order to provide a baseline for comparison to other alternatives. Under this alternative, no further actions would be taken to address the groundwater at the Chemfax, Inc. Site.	98	0
ALTERNATIVE No. 2 -Limited Action This alternative would also involve no further action to address the groundwater at the Site, other than the periodic monitoring discussed for Alternative 1. However, Alternative 2 would be implemented with the anticipation that natural processes can alone reduce the contaminant levels in the groundwater. If monitoring of the groundwater shows that natural processes are not breaking down the contaminants, then a contingent remedy would be put in place. Alternative 2 would also include institutional controls that would prevent installation of wells into the contaminated aquifer.	533	<1 year
ALTERNATIVE No. 3 -Pump and Treat With Physical and/or Chemical Treatment Alternative 3 would consist of an extraction system that would consist of wells or other mechanisms to pump groundwater to an on-site wastewater treatment system. The treated groundwater could then be discharged either to the Publicly Owned Treatment Works (POTW), injection wells, or surface water. The treatment system would consist of air stripping for the VOC compounds, whereas the PAH compounds would likely require an activated carbon process, also.	1,732	30 years
ALTERNATIVE No. 4 - In-situ Treatment Alternative 4 would treat the groundwater in place, without pumping it to the surface. The treatment process would consist of air sparging, soil vapor extraction, bioaugmentation, or a combination of the three.	2,305	1 year
ALTERNATIVE No. 5 - Permeable Treatment Bed Alternative Five consists of construction of a permeable treatment bed (or treatment wall). As contaminated groundwater flows through the treatment wall, contaminants are treated via physical, chemical, and/or biological processes. The natural gradient of the groundwater can be used to provide continuous flow across the treatment wall, as opposed to pumping. Additional Site characterization would be required for this alternative, to optimize the design of the treatment bed.	3,037	30 years

10.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME

Reduction of toxicity, mobility, or volume refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

Alternatives 2 through 5, as described for soils/sediments, each call for treatment of the contaminated soils/sediments to performance standards, and are ranked equally for this criterion. Alternative 6 would reduce the volume of soils/sediments only at the Site itself, and would not reduce toxicity or volume; this alternative thus ranks lower than Alternatives 2 through 5 for this criterion.

Alternatives 3, 4, and 5, as described for groundwater,each call for treatment of the contaminated groundwater to performance standards, and are ranked equally for this criterion.

10.5 SHORT-TERM EFFECTIVENESS

Short-term effectiveness addresses the period of time needed to implement the remedy, and considers any adverse impacts that may be posed to workers and the community during construction and operation of the remedy.

Alternatives 3 and 5, as described for soils/sediments, require more effort to construct their treatment technologies (thermal desorption and gas-phase chemical reduction, respectively) than do Alternatives 2 and 4, and is thus ranked lower than Alternatives 2 and 4. Alternative 6 ranks equally with Alternatives 2 and 4, with respect to short-term effectiveness.

Alternatives 3, 4, and 5, as described for groundwater, are each ranked equally with respect to short-term effectiveness.

10.6 IMPLEMENTABILITY

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

Alternatives 2 through 5, as described for soils/sediments, would each require treatability studies and testing during Remedial Design to determine their effectiveness. They are thus ranked lower than Alternative 6 for this criterion.

Alternatives 3, 4, and 5, as described for groundwater, would each require effort during Remedial Design before the remedy could be implemented. Alternative 3 would require selection of a specific pump-and-treat alternative. Alternative 4 would require the design of an in-situ treatment system, whereas Alternative 5 would require the design of a Site-specific permeable treatment wall. However, Alternative 3 is ranked higher for this criterion because pump-and-treat technology is significantly less complex technically.

10.7 COST

Present worth cost estimates for the six soil/sediment alternatives, and for the five groundwater alternatives, are shown on Tables 6 and 7, respectively. Total costs for each alternative include estimated capital costs, as well as asssociated operation and maintenance (O&M) costs after the alternative is implemented. Present worth costs were calculated for a period of 30 years using an interest rate of 7%. Tables 8 and 9 summarize this cost information. All costs shown are taken from the Feasibility Study, dated April 18, 2000, and the Feasibility Study Addendum, dated June 7, 2000.

For soils/sediments, costs range from $66,142 for Alternative 1 - No Action, to $15,221,006 for Alternative 5 - Excavation and On-Site Treatment With Gas Phase Chemical Reduction.

For groundwater, costs range from $98,406 for Alternative 1 - No Action, to $3,036,849 for Alternative 5 - Permeable Treatment Bed.

Table 8
Cost Breakout For Soil/Sediment Alternatives
Chemfax, Inc. - Gulfport, Mississippi

Alternative	Capital Cost ($)	O&M Cost ($/year)	Total Present Worth Cost ($)
1- No Action	$0	$6,100	$66,142
2- In Situ Treatment w/Biodegradation, Bioventing	$291,000	$2,018,500	$2,304,761
3- Excavation, On-site Treatment w/ Thermal Desorption	$2,122,700	$235,000	$3,841,131
4- Excavation, On-site Treatment w/ Solid Phase Bioremediation	$2,048,200	$235,000	$3,720,068
5-Excavation, On-site Treatment w/ Gas Phase Chemical Reduction	$9,125,700	$235,000	$15,221,006
6-Excavation, Off-Site Transportation, Disposal at Subtitle D Landfill	$909,000	$65,000	$1,709,990

Table 9 Cost Breakout For Groundwater Alternatives Chemfax, Inc. - Gulfport, Mississippi			
Groundwater Alternative	Capital Cost ($)	O&M Cost ($/year)	Total Present Worth Cost ($)
1- No Action	$0	$8,700	$98,406
2- Limited Action	$115,000	$157,700	$533,113
3- Pump and Treat with Physical and/or Chemical Treatment	$191,425	$121,625	$1,732,493
4- *In-Situ Treatment*	$291,000	$2,018,500	$2,304,761
5- Permeable Treatment Bed	$562,000	$179,625	$3,036,849

10.8 STATE ACCEPTANCE

The State of Mississippi, as represented by the Missisipi Department of Environmental Quality (MDEQ), has assisted in the Superfund process through the review of RI/FS documents, and has also submitted comments on the State's behalf for the selected remedy documented in this decision document. The State concurs with the selected remedy.

10.9 COMMUNITY ACCEPTANCE

Based on the comments expressed at the July 20, 2000 public meeting and recorded in the transcript thereof (no written comments were received during the comment period), the community in the vicinity of the Site does not oppose the selected remedies as described within this Record of Decision, for the impacted soils, sediments, and groundwater at the Site.

Based on the comments expressed from the community during the July 20, 2000 public meeting, additional surface water and sediment sampling will be done in Bernard Bayou, as part of this remedy. This sampling will be done to provide continued assurance that Bernard Bayou remains unimpacted by the site, as indicated by the 1995 Remedial Investigation results.

11.0 PRINCIPAL THREAT WASTES

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable. In general, principal threat wastes are those source materials which cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. Contaminated groundwater is not generally considered to be a source material.

At the Chemfax, Inc. the greatest current risk would come from the surficial groundwater, were it to be used as a drinking water source. However, the principal threat at the Site is from the contaminated soils and/or sediments that will continue to contaminate the groundwater at levels above drinking water levels, if those soils/sediments were to be left unremediated. The selected remedy set forth in this Record of Decision will have these principal threat soils and/or sediments excavated and disposed off-site without treatment, whereas the other four alternatives (not including Alternative 1, No Action) would meet the NCP's expectation of treating principal threats at the Site.

12.0 THE SELECTED REMEDY

Based on CERCLA requirements, the NCP, the detailed analysis of alternatives, and comments from both the State and the community, EPA has determined that, for those alternatives described for soils/sediments, Alternative 6 (Excavation, Off-site Transportation and Disposal At Approved Disposal Facility) constitutes the best overall soil/sediment remedial action for the Site. Likewise, for those alternatives described for the contaminated groundwater, EPA has determined that Alternative 3 (Pump and Treat With Physical and/or Chemical Treatment) constitutes the best overall groundwater remedial action for the Site. Designation of a portion of the Site as a Corrective Action Management Unit (CAMU) will be necessary, in order to comply with EPA's Resource Conservation and Recovery Act (RCRA) regulations with respect to land disposal restrictions (LDRs). These LDRs would be triggered if the excavated soils were to meet the criteria for hazardous waste, as defined under RCRA.

As noted in Section 8.7, the present worth costs for implementing these remedies will be $1,709,990 for the selected soils/sediments remedy, and $1,732,493 for the groundwater remedy. Thus, total costs for both remedy selections will be $3,442,483.

There will be additional groundwater sampling conducted during the Remedial Design of the selected groundwater remedy. It has been postulated that the groundwater deeper than the 15' groundwater zone has not been impacted by the Site. However, that postulation is based in large part on the deeper temporary well at location 16 (see Figure 2-3; please note that although location 16 is not shown on that map, it is located in the same position as temporary well 7). As discussed in Sections 5.3.1.1 and 5.3.1.2, some contamination has been seen in monitoring well MW-02B. It is possible that additional sampling south and west of temporary location 16 could show contamination in the deeper zone that has not been seen before. Therefore, as part of the selected remedy and during Remedial Design, additional sampling will be conducted in the deeper zone. If warranted, the deeper zone will also be remediated using the selected groundwater remedy, with additional wells installed as necessary.

This additional groundwater sampling will also investigate the two plume uncertainties that were discussed in Section 5.3.1.2. The first is located in the southeast corner of the site, located between temporary well location 1 and monitoring well MW-3A. The second plume uncertainty is located in the vicinity of monitoring well MW-06A, in the northern portion of the site.

Finally, this additional groundwater work should include provision for measuring water levels in the existing monitoring wells, for the purpose of determining tidal influences, if any, on the shallow groundwater aquifer underneath the site. This work will include additional characterization of the groundwater contaminant plume to evaluate and establish monitoring points for determining whether discharge of the contaminated groundwater to Bernard Bayou will occur at levels of potential human or environmental risk.

During the July 20, 2000 proposed plan public meeting, additional sampling of the sediments and surface water in Bernard Bayou was discussed. At that meeting, EPA said that additional sampling in Bernard Bayou would be conducted - that sampling will be done as part of this selected remedy, to confirm that Bernard Bayou continues to remain unimpacted by the site.

12.1 GROUNDWATER PERFORMANCE STANDARDS

Groundwater performance standards are based on drinking water standards, and include federal Maximum Contaminant Levels (MCLs) and Applicable or Relevant and Appropriate Requirements (ARARs), including State standards, and also may include risk-based performance standards.

Groundwater will be remediated until the performance standards shown below are met, for the chemicals of concern shown (units are parts per billion, or ppb). Benzene, toluene, and ethylbenzene have performance standards based on their Maximum Contaminant Levels (MCLs) set forth under the Safe Drinking Water Act.

However, the last four chemicals shown have performance standards that are risk-based: methyl butyl ketone, naphthalene, and 2-methylnaphthalene are based on a residential non-cancer hazard quotient of 1.0; whereas bis(2-chloroethyl)ether is based on a residential cancer risk level of 10E-4. These performance standards differ significantly from what was proposed to the public in July, 2000. However, that proposed plan used a non-cancer hazard quotient of 0.1, when EPA typically uses a value of 1.0 in such cases. In the case of bis(2-chloroethyl)ether, current laboratory procedures do not quantify this compound below a value of 2 ppb.

It is important to note that the scope and cost of the remedy as set forth in this document is unlikely to be affected by the changes made to these four performance standards. For example, bis(2-chloroethyl)ether and methyl butyl ketone were only found in 1999 in one groundwater sample (see Table 1 on page 13) and are not thought to be site-related, as they were not found in soil samples.

Benzene	5 ppb
Toluene	1,000 ppb
Ethylbenzene	700 ppb
Naphthalene	310 ppb
Methyl butyl ketone	630 ppb
2-Methylnaphthalene	310 ppb
Bis(2-chloroethyl)ether	2 ppb

12.1.1 AQUIFER RESPONSE AND PUMP TESTING

Additional geological and engineering data are to be collected regarding the hydrogeologic properties of the surficial aquifer. The additional data will help determine if the system put in place will be capable of establishing hydraulic control of the contaminated groundwater at the Site, in addition to confirming how well the conceptual model of the aquifer fits the hydrogeological data.

Groundwater modeling will be conducted as necessary, as part of the Remedial Design, in an attempt to predict how the aquifer will respond to the pumping system.

12.1.2 COMPLIANCE TESTING/MONITORING

Groundwater monitoring shall be conducted semi-annually at this Site for the first two years following the installation of the groundwater remedy. After the first two years of monitoring on a semi-annual basis, monitoring will continue at least annually until the groundwater performance standards are met.

12.2 SOILS/SEDIMENTS PERFORMANCE STANDARDS

Soils at the Site will be remediated based on the protection of groundwater, including the small holding pond where samples SD 205/235 were collected during the RI. An estimated 14,900 cubic yards of soil will require remediation, to protect groundwater from contaminated leachate (see Figure 2-13, which was taken from the FS). Confirmatory samples will be taken after excavation of these soils/sediments. The following performance standards, based on the protection of groundwater, will be achieved:

Benzene	0.04 parts per million (ppm)
Toluene	8.4 ppm
Ethylbenzene	5.9 ppm
Naphthalene	8.4 ppm

12.3 EXPECTED OUTCOMES OF THE REMEDY

The site is currently zoned for industrial and commercial use. However, upon implementation of the soil/sediment portion of the selected remedy (i.e., excavation and off-site disposal), it is anticipated that the Site soils would be available for a residential land use. An unrestricted land use would not be available until the groundwater performance standards are met. It is anticipated that the groundwater performance standards can be met within a 30 year time frame, if not sooner.

Since the Site's value is enhanced by its proximity to the Interstate 10 interchange at Highway 49, restoring the Site to a productive use will also restore lease payments to the County that are currently being unrealized. This restoration should help revitalize the local community, and will at a minimum remove a potential source of urban blight.

Achievement of the soil/sediment and groundwater performance standards will also remove the potential for any impact to Bernard Bayou.

13.0 STATUTORY DETERMINATION

Under Section 121 of CERCLA, 42 U.S.C. § 9621, EPA must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), are cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element. The following sections discuss how the selected remedy meets these statutory requirements.

13.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected remedy provides protection of human health and the environment by: eliminating, reducing, and controlling risk through engineering controls and/or institutional controls; and via soil/sediment and groundwater treatment as delineated through the performance standards described in Section 12.0 - The Selected Remedy. The residual carcinogenic risk at the Site will be reduced to acceptable levels (i.e., cancer risk between 10^{-6} and 10^{-4}) once performance standards are achieved. Implementation of this remedy will not pose unacceptable short-term risks or cross media impact.

13.2 ATTAINMENT OF THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

The selected remedy will comply with the substantive requirements of federal and state laws and regulations that have been determined to constitute applicable or relevant and appropriate requirements (ARARS).

Applicable requirements are those cleanup standards, control standards, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a Superfund site. Relevant and appropriate requirements are those cleanup standards, control standards, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable, address problems or situations sufficiently similar (relevant) to those encountered and are well-suited (appropriate) to circumstances at the particular site.

Other guidance To Be Considered (TBCs) include health-based advisories and guidance.

13.3 COST EFFECTIVENESS

After evaluating all of the alternatives which satisfy the two threshold criteria (protection of human health and the environment, and attainment of ARARs), EPA has concluded that the selected soil/sediment and groundwater remedies, Alternatives 6 and 3, respectively, afford the highest level of overall effectiveness proportional to their cost. Section 300.430(f)(1)(ii)(D) of the NCP also requires EPA to evaluate three out of five balancing criteria to determine overall effectiveness: long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; and short-term effectiveness. Overall effectiveness is then compared to cost to ensure that the remedy is cost-effective. The selected remedies provide for overall effectiveness in proportion to their costs.

For soils/sediments, Alternative 1 - No Action, does not satisfy the primary criteria. The selected remedy is, with the exception of Alternative 1 - No Action, the least expensive of the alternatives for this Site, at a present worth cost of $1,709,990. Alternative 5 was by far the most expensive; at $15,221,006, it was over 11 million dollars more expensive than the second most expensive alternative, which was Alternative 3. Alternatives 3 and 4 cost roughly the same, but their increased cost (about 2 million dollars more than the selected remedy) was

Table 10 Summary of ARARs for Selected Remedy Chemfax, Inc. Gulfport, Mississippi	
Selected Remedy Major Components	**ARARs**
• Excavation of contaminated site soils/sediments • Short-term staging of contaminated site soils/sediments on-site • Transportation and disposal of contaminated site soils/sediments to approved disposal facility • Groundwater extraction wells • Treatment of groundwater via physical and/or chemical means • Treatment of air emissions as necessary • Groundwater disposal to POTW, Bernard Bayou, and/or injection wells	<u>Chemical-Specific</u> • Resource Conservation and Recovery Act (40 CFR 262-265, 124, 270-1) • Federal groundwater classifications (55CFR 8732) • Clean Water Act (33 USC 1251-1376, 40 CFR 122, 131, 230) • Safe Drinking Water Act (40 USC 300, 40 CFR 141, 143) • Clean Air Act (42 USC7409 et seq., 40 CFR 50) • Mississippi Ambient Air Quality Standards (APC-S-4) • Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Water Control (MDEQ) • Mississippi Air Quality Control (APC-S-1) <u>Location-Specific</u> • National Historic Preservation Act (16 USC 470, 36 CFR 800) • Archaeological and Historic Preservation Act (16 USC 469, 40 CFR 6.301(c)) • Floodplain Management Executive Order E.O. 11988) • Wetlands Management Executive Order (E.O. 11990) • Protection of Wetlands and Floodplains (40 CFR 6, App. A) • Historic Sites, Buildings, and Antiquties Act (16 USC 461-467, 40 CFR 6.301(a) • Endangered Species Act (16 USC 1531, 40 CFR 6.302, 50 CFR 402 • Fish and Wildlife Coordination Act 16 USC 661-666c) • Migratory Bird Treaty Act of 1973 (16 USC 703) • Emergency Wetlands Resources Act (16 USC 3901) • U.S. Fish and Wildlife Service Mitigation Policy (NPI#89-02) • National Environmental Policy Act (16 USC 4331, 40 CFR Part 1501) • Resource Conservation and Recovery Act (40 CFR 264) <u>Action-Specific</u> • Hazardous Materials Transportation Act (49 CFR 10, 171-177) • Resource Conservation and Recovery Act (40 CFR 257, 263, 264) • Clean Water Act (33 USC 1342, 40 CFR 122, 230) • Occupational Safety and Health Administration (29 CFR 1910)

not considered justifiable. Alternative 2 was more expensive than the selected remedy, and was considered attractive since it would satisfy the statutory preference for treatment to reduce toxicity, mobility, or volume.

For groundwater, Alternative 1 - No Action, does not satisfy the primary criteria. The selected remedy is, with the exception of Alternatives 1 (No Action) and 2 (Limited Action), the least expensive of the alternatives for this Site, at a present worth cost of $1,732,493. Alternative 2 is not as effective as the selected remedy. Alternative 5 was the most expensive, at a present worth cost of $3,036,849. Alternative 4 was more expensive than the selected remedy, but is not as implementable as the selected remedy.

The estimated present worth costs for the selected remedies for both groundwater and soils/sediments are $3,442,483.

13.4 UTILIZATION OF PERMANENT SOLUTIONS TO THE MAXIMUM EXTENT PRACTICABLE

EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the final remediation at the Site. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that Alternative 6 for soils/sediments, and Alternative 3, for groundwater, provide the best balance of trade-offs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume achieved through treatment, short-term effectiveness, implementability, and cost, while also considering the statutory preference for treatment as a principal element and consideration of state and community acceptance.

The selected remedy represents a permanent solution with respect to the principal threats posed by the Site.

13.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The selected remedy does not utilize treatment as a principal element, for the principal threats remaining at this site. As discussed in Section 11.0, the principal threats remaining at this site are the contaminated soils and/or sediments that will continue to contaminate the groundwater at levels above the performance standards, if those soils/sediments were to be left unremediated.

The benefits of treatment for these soils/sediments would be reduction of toxicity, mobility, and/or volume. However, these benefits do not justify the much higher costs associated with the soil/sediment treatment alternatives.

13.6 FIVE-YEAR REVIEW REQUIREMENTS

The NCP requires Five-Year Reviews at this site, since the remedy will take longer than five years to reach the groundwater performance standards set forth in this document. The reviews will be triggered when the construction is completed for the remedy, and will be discontinued when the performance standards are reached in the groundwater. The attainment of both the groundwater and soil/sediment performance standards will allow an unlimited use and unrestricted exposure for this site.

14.0 EXPLANATION OF SIGNIFICANT CHANGES

The Proposed Plan was released to the public in July, 2000. It identified **Removal & Off-site Disposal** as the preferred alternative for remediation of site soils and sediments, and **Pump and Treat With Physical and/or Chemical Treatment** as the preferred alternative for remediation of the groundwater beneath the site. During the preparation of this decision document, it was discovered that three of the performance standards for groundwater were based on inappropriate risk levels, and a fourth was based on a risk level that could not be monitored with current laboratory procedures. Therefore, these performance standards were changed to more appropriate levels. As discussed in Section 12.1, the scope and cost of the remedy as set forth in this document is unlikely to be affected by these changes.

Future changes to the remedies selected, if and when made, will be documented appropriately and included as part of the Admistrative Record. Extensive changes to the remedy may require an amendment to this Record of Decision (ROD). A ROD Amendment would require that the change to the remedy be presented to the public with another proposed plan, with a corresponding public comment period. If the change to the remedy is not extensive enough to warrant a ROD Amendment, then an Explanation of Significant Difference (ESD) would be issued to the Site mailing list.

APPENDIX A

RESPONSIVENESS SUMMARY - CHEMFAX, INC. NPL SITE

The Responsiveness Summary shows how EPA considered public comments made on the Remedial Action summarized herein, for the Chemfax, Inc. NPL Site. For additional reference, a transcript of the public meeting held July 20, 2000 is part of the Administrative Record for the Site. A copy of the Administrative Record is available for review at the information repository, which has been set up at the Orange Grove Public Library, located at 12031 Mobile Avenue, Gulfport, Mississippi. No written comments were received during the public comment period for the Remedial Action. All issues identified were taken from the transcript referenced above.

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1. What will be the anticipated timeframe before remedial action can actually begin?

   EPA Response:

   The next step in the NPL cleanup process is documenting the remedy selection in the Record of Decision (ROD). Following finalization of the ROD, Remedial Design (RD) would begin. RD may take about a year to complete. Remedial Action, or RA, would involve the actual cleanup of the Site, and might take place about six months after the RD is finalized.

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2. What is NPL?

   EPA Response:

   The NPL is the National Priorities List. The NPL is Superfund's vehicle for performing remedial cleanups pursuant to the Comprehensive Environmental Response, Liability, and Compensation Act of 1980 (CERCLA).

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3. [Are] VOCs beginning to volatilize and in time... just biodegrade on its own?

   EPA Response:

   As part of the remedy, groundwater would be pumped through a treatment tower, and air would be pumped through the groundwater. Contaminants in the groundwater would be "stripped" from the groundwater, and would enter the air, or gas, phase.

The process is not involved with biodegradation. And contaminants would not be expected to biodegrade on their own, if remedial action is not conducted.

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4. *Is [air stripping] one of the options?*

EPA Response:

Yes. Air stripping is a physical and chemical process that was presented as part of the preferred alternative, and as such, is one of the options available for the remedial action. However, it is possible (but unlikely) that Remedial Design could indicate another physical/chemical process as preferable to air stripping.

---

5. *[Is] air stripping a chemical treatment?*

EPA Response:

Air stripping can be considered as both a chemical and physical process. It is a chemical process in the sense that dissolved contaminants in the groundwater are transformed from a liquid state to a gaseous state. But the process itself is primarily physical, as only air is pumped through the groundwater.

The by-product would be the contaminants themselves as they are removed from the groundwater. There is no chemical treatment added to the groundwater, except air.

There would not be cooling towers involved with the air stripping process. There would be equipment installed, such as gas scrubbers, that would capture the contaminants removed from the groundwater. Air emissions from the treatment equipment would be monitored to ensure that no problems are encountered with air releases.

---

6. Will... the soil removal [be done] first so that it won't

continue to leach into this water?

EPA Response:

Yes, that would be the best way to do it. Issues such as these will be addressed during the Remedial Design.

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7. How will [EPA] dispose of that soil? Where will [EPA] take it?

EPA Response:

The soils will be taken to an off-site, approved disposal facility.

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8. When [EPA was] here last year, didn't you remove all those drums?

EPA Response:

Yes. During the 1999 removal action conducted by EPA, the drums remaining on the Site were disposed of off-site.

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9. [Is there any] possible danger to aquatic human receptors? [And is there] groundwater flow to [Bernard Bayou]?

EPA Response:

With respect to human receptors, the four surface water and sediment samples that were collected from Bernard Bayou do not indicate any impact from the Site that would represent a threat to humans from eating the aquatic life in the bayou.

Regarding ecological receptors, there has been groundwater sampling on two occasions at the Site, in 1995 and 1999. The well closest to Bernard Bayou does not indicate that groundwater discharging to the bayou will have any adverse impacts to the aquatic life in the bayou. The surface water and sediment samples cited in the above paragraph also indicate that aquatic receptors are not being impacted by the Site.

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10. [Will EPA finalize the selected remedy for remedial action after] comments [are considered] from the state and community or from the state or community? I'm not sure you said and or on that statement.

    EPA Response:

    The preferred remedy that was presented at the public meeting, for soils/sediments and groundwater at the Site, becomes final only after comments are considered from both the community and the State.

---

11. What about land use restrictions after the remedial action? Will there be any?

    EPA Response:

    The preferred remedy does not include land use restrictions. The Baseline Risk Assessment for Human Health (BRA-HH) indicated that the Site did not pose an unacceptable risk to a lifetime resident.

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12. Was soil removed prior to now? Has there been some work done on this Site?

    EPA Response:

    EPA's Superfund conducted a removal action in 1999 that was separate from the remedial action that is being proposed here.

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13. When can something be built on the property? When will you release the land for development? Because I know the city is interested in, right now, there's a railroad track that's near that Site, and it's in pretty bad shape because cars go back and forth over it, and they wanted to repair it, and they were kind of afraid to repair it because you were still doing your cleanup. So could you give me some information on when you will release the land for development?

EPA Response:

EPA is aware that the Mississippi Department of Transportation (MDOT) is interested in constructing a rail spur across the Site, in order to eliminate one of the railroad crossings at Highway 49.

EPA does not actually release the land for development. If development of the Site were to occur in such a way that implementation of the cleanup remedy were to be compromised, EPA could take steps to remove that development.

At the same time, EPA does encourage re-development of Superfund sites, in order to return them to productive use within the community. Re-development of parts of the Site could occur if it is not thought that the cleanup remedy would be compromised.

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14. What is PRP?

EPA Response:

PRP is an acronym for Potentially Responsible Party.

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15. [We are] concerned about people fishing right there next to the Site, [in Bernard Bayou]. People have been fishing there for a long time. And my question is, did you actually find something there?

EPA Response:

See response to #14. The sediment and surface water samples taken from Bernard Bayou in 1995 did not indicate a need to issue a fish advisory for Bernard Bayou.

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16. Is there any... any type of monitoring going on... where people do fish often? Is there any type of monitoring of the water system there? Is... any of the fish or aquatic life being... sampled to make sure there is [not a problem]?

EPA Response:

There is no monitoring program being conducted for the Site. There have been two sampling investigations at this Site: the 1995 Remedial Investigation during which soil, sediment, surface water, and groundwater sampling was done; and the 1999 Supplemental Investigation, during which only groundwater sampling was done. These samples did not indicate a need for monitoring of the bayou.

However, as was discussed at the July 20, 2000 meeting, more sediment and surface water sampling will be done in the bayou to verify that there continues to be no impact from the Site, from either surface water runoff or groundwater discharge to the bayou.

There is no regular monitoring program set up for the permanent monitoring wells. They will be re-sampled during the Remedial Design.

---

17. There is no obvious danger right now to human or aquatic receptors? One of the comments written here says that potential routes for human exposure includes ambient air, surface water and edible fish from the Industrial Seaway, groundwater, well water and public supply water. And this was taken off the internet, of course, regarding the Chemfax, Inc., public health assessment. If you don't have any wells in, how do you not know, and have not been tested yet that there aren't problems existing at the Site and off-site? How do you come to these determinations if the wells are not there and being checked and there are some potential routes for human exposure here regarding the Chemfax Site?

EPA Response:

The report that was mentioned at the meeting was the March 2, 1995 Public Health Assessment by the Agency for Toxic Substances and Disease Registry (ATSDR).

It is important to recognize that this report was finalized before any of the data was available from the 1995 Remedial Investigation. In addition, groundwater was investigated in 1999, and soil sampling was also done as part of EPA's removal action in 1999.

The Baseline Risk Assessment for Human Health (BRA-HH), finalized in 1999, also provides information for these determinations. The BRA-HH was not available at the time of the ATSDR report.

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18. Does the Site... qualify for the Brownfields Program?

EPA Response:

No. The Brownfields Program focuses on sites for which there is a perception of contamination, and does so by providing funds for assessment purposes. The Chemfax, Inc. Site, however, would not be a candidate for the Brownfields Program since its assessment under Superfund resulted in its proposal to the National Priorities List.

On September 11, 2000, Mr. Micky Hartnett with EPA called the person asking this question, and discussed further the Brownfields Program.

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19. Has there been any type of community outreach to have the people come forward? If it's kept quiet, no one will come forward if they don't know to come forward in reference to this. The people in this community need to be informed of the potential health hazards or something that they may come in contact with.

EPA Response:

EPA will continue to keep the public informed via its mailing list and through the media. EPA will add the radio stations mentioned at the July 20, 2000 meeting to the Site mailing list.

APPENDIX B
CONCURRENCE LETTERS

STATE OF MISSISSIPPI
DAVID RONALD MUSGROVE, GOVERNOR
MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY
CHARLES H. CHISOLM, EXECUTIVE DIRECTOR

June 4, 2001

WMD/SSMB
RECEIVED
JUN 6 2001
EPA-REGION 4
ATLANTA, GA

Mr. Brian Farrier
State Programs Section
Waste Management Division
U.S. EPA Region IV
61 Forsyth Street SW
Atlanta, GA 30303-3104

Re: Record of Decision (ROD)
Chemfax Inc., NPL Site
Gulfport, Harrison County, MS

Dear Mr. Farrier:

The Mississippi Department of Environmental Quality (MDEQ) has reviewed the Record of Decision (ROD) for the Chemfax Inc., NPL Site submitted to MDEQ for review in September of 2000. MDEQ concurs with the selected remedial action remedy for the Site. This concurrence is based on technical feasibility but does not necessarily represent the State's commitment to carry out the clean-up in that exact manner.

In the state's role as the potentially responsible party (PRP), MDEQ is continuing to assist the Secretary of State's office in assessing the consistency of past EPA actions with the National Contingency Plan (NCP); and the state does not waive the issue of whether future actions of EPA will be not inconsistent with the NCP. If you have any questions or comments, please feel free to call me at 601-961-5221.

Sincerely,

Jerry B. Banks

Jerry Banks, P. E., DEE
Chief, Hazardous Waste Division

cc: Bill Chaney, Esq.
Kelli M. Dowell, Esq.

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APPENDIX C

RAGS PART D STANDARD FORMAT TABLES

The following selected tables were taken from the February, 2000 Baseline Risk Assessment for Human Health (BRA-HH):

1	Selection of Exposure Pathways
2.1	Occurrence and Distribution of Chemicals of Potential Concern - Soil
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4.3RME	Values Used for Daily Intake Calculations: Child Resident Scenario - Ingestion and Dermal Contact with Soil; Inhalation of Dust
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Table 1
Selection Of Exposure Pathways
Chemfax, Inc. Superfund Site

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/ Future	Soil	Soil	Process Area	Trespasser/ visitor	Adolescents	Ingestion	On-site	Quant.	Site visitors may accidentally ingest soil.
						Dermal	On-site	Quant.	Site visitors may come into contact with soil.
		Air	Process Area	Trespasser/ visitor	Adolescents	Inhalation	On-site	Quant.	Site visitors may inhale dust released from soil.
	Surface Water	Surface Water	Creek	Trespasser/ visitor	Adolescents	Ingestion	On-site	None	Surface water not conducive to swimming or wading.
						Dermal	On-site	None	Surface water not conducive to swimming or wading.
Future	Soil	Soil	Process Area	Worker	Adult	Ingestion	On-site	Quant.	Site workers may accidentally ingest soil.
						Dermal	On-site	Quant.	Site workers may come into contact with soil.
		Air	Process Area	Worker	Adult	Inhalation	On-site	Quant.	Site workers may inhale dust released from soil.
		Soil	Process Area	Resident	Child	Ingestion	On-site	Quant.	Site residents may accidentally ingest soil.
						Dermal	On-site	Quant.	Site residents may come into contact with soil.
		Air	Process Area	Resident	Child	Inhalation	On-site	Quant.	Site residents may inhale dust released from soil.
		Soil	Process Area	Resident	Adult	Ingestion	On-site	Quant.	Site residents may accidentally ingest soil.
						Dermal	On-site	Quant.	Site residents may come into contact with soil.
		Air	Process Area	Resident	Adult	Inhalation	On-site	Quant.	Site residents may inhale dust released from soil.
	Ground-water	Ground-water	Well	Resident	Child	Ingestion	On-site	Quant.	Groundwater may be used as a drinking water source in the future.
		Air	Well	Resident	Child	Inhalation	On-site	Quant.	Eposure to VOCs while showering may be a complete exposure route.
		Ground-water	Well	Resident	Adult	Ingestion	On-site	Quant.	Groundwater may be used as a drinking water source in the future.
		Air	Well	Resident	Adult	Inhalation	On-site	Quant.	Eposure to VOCs while showering may be a complete exposure route.
		Ground-water	Well	Worker	Adult	Ingestion	On-site	Quant.	Groundwater may be used as a drinking water source in the future.

Table 2.1
Occurrence and Distribution of Chemicals of Potential Concern
Chemfax, Inc. Superfund Site

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration/ Qualifier[1]		Maximum Concentration/ Qualifier[1]		Units	Location of Maximum Concentration	Detection Frequency[2]	Range of Detection Limits	Concentration used for Screening	Background Value	Screening Toxicity Value (N/C)[3,4]		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Contaminant Selection or Deletion[5]
Site	7429-90-5	*Aluminum*	2,000	-	18,000	-	mg/kg	126-SLA	12 / 12	NA / NA	18,000	3700	7,821	N	NA	NA	Y	ASL
Site	7440-36-0	*Antimony*	1	J	7	J	mg/kg	156-SLA	2 / 12	1 / 4	7	0.7	3.1	N	NA	NA	Y	ASL
Site	7440-38-2	*Arsenic*	3	J	7	-	mg/kg	140-SLA	8 / 12	2 / 3	7	1.4	0.43	C	NA	NA	Y	ASL
Site	7440-39-3	Barium	8	-	69	-	mg/kg	151-SLA	12 / 12	NA / NA	69	33.2	548	N	NA	NA	N	BSL
Site	7440-70-2	Calcium	440	-	130,000	J	mg/kg	151-SLA	12 / 12	NA / NA	130,000	2305	NA		NA	NA	N	Nut
Site	18540-29-9	*Chromium*	3	-	470	-	mg/kg	156-SLA	12 / 12	NA / NA	470	5.5	23.5	N	NA	NA	Y	ASL
Site	7440-50-8	Copper	8	-	150	-	mg/kg	156-SLA	12 / 12	7 / 7	150	12.8	313	N	NA	NA	N	BSL
Site	7439-89-6	*Iron*	1,200	-	51,000	-	mg/kg	156-SLA	12 / 12	NA / NA	51,000	3900	2,346	N	NA	NA	Y	ASL
Site	7439-92-1	Lead	7	-	63	-	mg/kg	108-SLA	11 / 11	NA / NA	63	24	400	N	NA	NA	N	BSL
Site	7439-95-4	Magnesium	130	-	290	-	mg/kg	166-SLA	12 / 12	NA / NA	290	695	NA		NA	NA	N	Nut
Site	7439-96-5	Manganese	8	-	990	-	mg/kg	156-SLA	12 / 12	3 / 3	990	50	1,095	N	NA	NA	N	BSL
Site	7440-02-0	Nickel	2	J	19	-	mg/kg	125-SLA	11 / 12	2 / 3	19	3.8	156	N	NA	NA	N	BSL
Site	7440-09-7	Potassium	86	-	550	-	mg/kg	166-SLA	12 / 12	60 / 60	550	295	NA		NA	NA	N	Nut
Site	7782-49-2	Selenium	2	-	2	-	mg/kg	126-SLA	1 / 12	1 / 1	2	0.6	39.1	N	NA	NA	N	BSL
Site	7440-23-5	Sodium	160	-	130,000	-	mg/kg	126-SLA	6 / 12	70 / 150	130,000	118	NA		NA	NA	N	Nut
Site	7440-62-2	Vanadium	3	J	36	-	mg/kg	156-SLA	12 / 12	NA / NA	36	10.2	55	N	NA	NA	N	BSL
Site	7440-66-6	Zinc	20	J	460	-	mg/kg	156-SLA	12 / 12	NA / NA	460	40.5	2,346	N	NA	NA	N	BSL
Site	319-85-7	beta-BHC	1.6	J	1.6	J	ug/kg	161-SLA	1 / 58	1.8 / 11	1.6	NA	355	C	NA	NA	N	BSL
Site	319-86-8	delta-BHC	7.2	-	7.2	-	ug/kg	107-SLA	1 / 58	1.8 / 11	7	NA	491	C	NA	NA	N	BSL
Site	309-00-2	Aldrin	1.4	J	11	-	ug/kg	142-SLA	10 / 58	1.8 / 20	11	NA	37.6	C	NA	NA	N	BSL
Site	1024-57-3	Heptachlor epoxide	6.5	-	15	-	ug/kg	156-SLA	6 / 58	1.8 / 30	15	NA	70.2	C	NA	NA	N	BSL
Site	959-98-8	Endosulfan I (alpha)	3.3	-	3.3	-	ug/kg	404-SLA	1 / 58	1.8 / 11	3	NA	46,929	N	NA	NA	N	BSL
Site	60-57-1	Dieldrin	1.4	J	7.2	-	ug/kg	144-SLA	6 / 58	3.5 / 40	7	NA	39.9	C	NA	NA	N	BSL
Site	72-55-9	4,4'-DDE (p,p'-DDE)	9.1	-	9.1	-	ug/kg	151-SLA	1 / 58	3.5 / 22	9	NA	1,879	C	NA	NA	N	BSL
Site	72-20-8	Endrin	28	-	28	-	ug/kg	152-SLA	1 / 58	3.5 / 25	28	NA	2,346	N	NA	NA	N	BSL
Site	33213-65-9	Endosulfan II (beta)	32	-	32	-	ug/kg	153-SLA	1 / 58	3.5 / 22	32	NA	46,929	N	NA	NA	N	BSL
Site	72-54-8	4,4'-DDD (p,p'-DDD)	0.9	J	82	-	ug/kg	441-SLA	10 / 58	3.5 / 90	82	NA	2,661	C	NA	NA	N	BSL
Site	0	Endrin ketone	16	J	18	-	ug/kg	107-SLA	2 / 58	3.5 / 22	18	NA	2,346	N	NA	NA	N	BSL
Site	5103-74-2	gamma-Chlordane /2	28	-	55	-	ug/kg	156-SLA	2 / 58	1.8 / 11	55	NA	1,825	C	NA	NA	N	BSL
Site	5103-71-9	alpha-Chlordane /2	2.5	-	7	-	ug/kg	102-SLA	2 / 58	1.8 / 20	7	NA	1,825	C	NA	NA	N	BSL
Site	108-95-2	Phenol	610	-	610	-	ug/kg	120-SLA	1 / 58	350 / 13,000	610	NA	4,692,857	N	NA	NA	N	BSL
Site	120-82-1	1,2,4-Trichlorobenzene	110	J	110	J	ug/kg	148-SLA	1 / 58	350 / 13,000	110	NA	78,214	N	NA	NA	N	BSL
Site	91-20-3	Naphthalene	50	J	130,000	-	ug/kg	138-SLA	39 / 58	250 / 2,600	130,000	NA	156,429	N	NA	NA	N	BSL
Site	91-57-6	2-Methylnaphthalene	45	J	12,000	-	ug/kg	138-SLA	33 / 58	350 / 1,800	12,000	NA	156,429	N	NA	NA	N	BSL
Site	208-96-8	Acenaphthylene	92	J	92	J	ug/kg	117-SLA	1 / 58	350 / 13,000	92	NA	234,643	N	NA	NA	N	BSL
Site	83-32-9	Acenaphthene	36	J	1,500	J	ug/kg	136-SLA	7 / 58	350 / 13,000	1,500	NA	469,286	N	NA	NA	N	BSL
Site	132-64-9	Dibenzofuran	51	J	51	J	ug/kg	101-SLA	1 / 58	350 / 13,000	51	NA	31,286	N	NA	NA	N	BSL
Site	86-73-7	Fluorene	70	J	70	J	ug/kg	133-SLA	1 / 58	350 / 13,000	70	NA	312,857	N	NA	NA	N	BSL
Site	85-01-8	Phenanthrene	43	J	8,900	-	ug/kg	109-SLA	41 / 58	360 / 520	8,900	NA	234,643	N	NA	NA	N	BSL
Site	120-12-7	Anthracene	43	J	1,400	-	ug/kg	152-SLA	9 / 58	350 / 13,000	1,400	NA	2,346,429	N	NA	NA	N	BSL
Site	206-44-0	Fluoranthene	50	J	3,200	-	ug/kg	152-SLA	32 / 58	360 / 13,000	3,200	NA	312,857	N	NA	NA	N	BSL
Site	129-00-0	Pyrene	46	J	6,400	-	ug/kg	109-SLA	36 / 58	360 / 3,400	6,400	NA	234,643	N	NA	NA	N	BSL
Site	56-55-3	*Benzo(a)anthracene*	48	J	3,700	-	ug/kg	109-SLA	12 / 58	350 / 13,000	3,700	NA	875	C	NA	NA	Y	ASL

Table 2.1
Occurrence and Distribution of Chemicals of Potential Concern
Chemfax, Inc. Superfund Site

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration/ Qualifier[1]		Maximum Concentration/ Qualifier[1]		Units	Location of Maximum Concentration	Detection Frequency[2]	Range of Detection Limits	Concentration used for Screening	Background Value	Screening Toxicity Value (N/C)[3,4]		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Contaminant Selection or Deletion[5]
Site	218-01-9	***Chrysene***	45	J	4,000	-	ug/kg	109-SLA	28 / 58	360 / 2,600	4,000	NA	87,497	C	NA	NA	N	Class
Site	117-84-0	Di-n-Octylphthalate	430	-	430	-	ug/kg	149-SLA	1 / 58	350 / 13,000	430	NA	156,429	N	NA	NA	N	BSL
Site	5-99-2/207-0	***Benzo(b and/or k)fluorant***	43	J	2,000	-	ug/kg	109-SLA	23 / 68	350 / 13,000	2,000	NA	8,750	C	NA	NA	N	Class
Site	50-32-8	***Benzo-a-pyrene***	58	J	1,800	-	ug/kg	109-SLA	10 / 58	350 / 13,000	1,800	NA	87	C	NA	NA	Y	ASL
Site	193-39-5	***Indeno (1,2,3-cd) pyrene***	300	J	300	J	ug/kg	109-SLA	1 / 58	350 / 13,000	300	NA	875	C	NA	NA	N	Class
Site	191-24-2	Benzo(ghi)perylene	130	J	130	J	ug/kg	149-SLA	1 / 58	350 / 13,000	130	NA	234,643	N	NA	NA	N	BSL
Site	71-43-2	Benzene	6	-	6	-	ug/kg	144-SLA	1 / 58	10 / 18	6	NA	22,025	C	NA	NA	N	BSL
Site	100-41-4	Ethyl benzene	2	-	14	-	ug/kg	135-SLA	3 / 58	10 / 18	14	NA	782,143	N	NA	NA	N	BSL
Site	1330-20-7	Total xylenes	4	-	330	-	ug/kg	144-SLA	4 / 58	10 / 18	330	NA	15,642,857	N	NA	NA	N	BSL

Footnotes:

1. Minimum/maximum detected concentration. Samples SLA-132, -134, -162, -163, and -164 deleted from data set due to removal action.

   "-" is a result that did not require qualification.
2. Number of samples taken and analyzed for the constituent. Sample number varies based on the number of usable results
3. Risk-based concentrations for residential soil obtained from: EPA Region III Risk-Based Concentration Table, obtained on-line 4/28/99. Units are ug/kg for organics and mg/kg for inorganics.
4. Toxicity value surrogates:
   pyrene used for benzo(g,h,i)perylene and phenanthrene
5. Rationale Codes — ASL - Above screening level
   Selection Reason: Class - Member of class that is a COPC
   Nut - Essential nutrient
   Deletion Reason: BSL - Below screening level

Definitions:
NA = Not Applicable
COPC = Chemical of Potential Concern (indicated by bold italics)
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
C = Carcinogenic
N = Non-Carcinogenic

Table 2.2
Occurrence And Distribution Of Chemicals Of Potential Concern
Chemfax, Inc. Superfund Site

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration/ *Qualifier*[1]		Maximum Concentration/ *Qualifier*[1]		Units	Location of Maximum Concentration	Detection Frequency[2]	Range of Detection Limits	Concentration used for Screening	Background Value	Screening Toxicity Value (N/C)[3,4]		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Contaminant Selection or Deletion[5]
Well	71-43-2	***Benzene***	52	-	7,100	-	ug/L	DPT-6	5 / 5	NA / NA	7,100	NA	0.36	C	5	MCL	Y	ASL
Well	75-15-0	Carbon disulfide	2	-	2	-	ug/L	DPT-11	1 / 5	33 / 500	2	NA	104	N	NA	NA	N	BSL
Well	100-41-4	***Ethyl Benzene***	22	J	2,800	-	ug/L	DPT-6	5 / 5	NA / NA	2,800	NA	134	N	700	MCL	Y	ASL
Well	591-78-6	***Methyl butyl ketone***	460	-	460	-	ug/L	MW-2A	1 / 5	10 / 500	460	NA	146	N	NA	NA	Y	ASL
Well	108-88-3	***Toluene***	5	J	1,300	-	ug/L	DPT-3	5 / 5	NA / NA	1,300	NA	75	N	1,000	MCL	Y	ASL
Well	1330-20-7	***Total Xylenes***	23	J	2,800	-	ug/L	DPT-6	5 / 5	NA / NA	2,800	NA	1,217	N	10,000	MCL	Y	ASL
Well	91-57-6	***2-Methylnaphthalene***	4	J	110	-	ug/L	DPT-5	4 / 5	20 / 20	110	NA	12	N	NA	NA	Y	ASL
Well	208-96-8	Acenaphthylene	2	J	2	J	ug/L	DPT-11	1 / 5	20 / 600	2	NA	18	N	NA	NA	N	BSL
Well	111-44-4	***Bis(2-Chloroethyl) ether***	38	J	38	J	ug/L	DPT-6	1 / 5	20 / 20	38	NA	0.01	C	NA	NA	Y	ASL
Well	86-73-7	Fluorene	2	J	2	J	ug/L	DPT-11	1 / 5	20 / 600	2	NA	24	N	NA	NA	N	BSL
Well	91-20-3	***Naphthalene***	4	J	2,000	-	ug/L	DPT-6	5 / 5	NA / NA	2,000	NA	0.65	N	NA	NA	Y	ASL
Well	85-01-8	Phenanthrene	1	J	1	J	ug/L	DPT-3	1 / 5	20 / 600	1	NA	18	N	NA	NA	N	BSL
Well	108-95-2	Phenol	12	-	12	-	ug/L	MW-2A	1 / 5	20 / 600	12	NA	2,190	N	NA	NA	N	BSL
Well	7440-39-3	Barium	26	-	26	-	ug/L	MW-2A	1 / 1	NA / NA	26	NA	256	N	2,000	MCL	N	BSL
Well	7440-70-2	Calcium	530	-	530	-	ug/L	MW-2A	1 / 1	NA / NA	530	NA	NA		NA	NA	N	Nut
Well	7439-89-6	Iron	750	-	750	-	ug/L	MW-2A	1 / 1	NA / NA	750	NA	1,095	N	300	SMCL	N	BSL
Well	7439-95-4	Magnesium	350	-	350	-	ug/L	MW-2A	1 / 1	NA / NA	350	NA	NA		NA	NA	N	Nut
Well	7439-96-5	Manganese	29	-	29	-	ug/L	MW-2A	1 / 1	NA / NA	29	NA	73	N	50	SMCL	N	BSL
Well	7440-09-7	Potassium	1,300	-	1,300	-	ug/L	MW-2A	1 / 1	NA / NA	1,300	NA	NA		NA	NA	N	Nut
Well	7440-23-5	Sodium	11,000	-	11,000	-	ug/L	MW-2A	1 / 1	NA / NA	11,000	NA	NA		NA	NA	N	Nut
Well	7440-66-6	Zinc	2	J	2	J	ug/L	MW-2A	1 / 1	NA / NA	2	NA	1,095	N	5,000	SMCL	N	BSL

Footnotes:

1. Minimum/maximum average detected concentration in monitor well 2A, and DPT points 3, 5, 6, and 11.
2. Number of samples taken and analyzed for the constituent. Sample number varies based on the number of usable results.
3. Risk-based concentrations for groundwater obtained from: EPA Region III, Risk-Based Concentration Table, obtained on-line 4/28/99. Units are ug/L.
4. Toxicity value surrogates:
   pyrene used for acenaphthylene
5. Rationale Codes
   Selection Reason: ASL - *Above screening level*
   Deletion Reason: BSL - Below screening level
   Nut - Essential nutrient

Definitions:
NA = Not Applicable
COPC = Chemical of Potential Concern (indicated by bold italics)
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
MCL = Federal Maximum Contaminant Level
C = Carcinogenic
N = Non-Carcinogenic
MCL = Maximum Contaminant Level
SMCL = Secondary Maximum Contaminant Level

Table 3.1RME
Exposure Point Concentrations Summary
Reasonable Maximum Exposure
Chemfax, Inc. Superfund Site

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean[1]	95% UCL of Log-Transformed Data[1]	Maximum Concentration/ Qualifier[2]		Exposure Point Concentration			
							Value	Units	Statistic[3,4]	Rationale
Site	Aluminum	mg/kg	6,317	10,104	18,000	-	10,104	mg/kg	95% UCL-T	Reg IV Guidance
Site	Antimony	mg/kg	1.4	2.2	7.4	J	2.2	mg/kg	95% UCL-T	Reg IV Guidance
Site	Arsenic	mg/kg	2.9	5.1	7.2	-	5.1	mg/kg	95% UCL-T	Reg IV Guidance
Site	Chromium	mg/kg	46	89	470	-	89	mg/kg	95% UCL-T	Reg IV Guidance
Site	Iron	mg/kg	10,683	20,186	51,000	-	20,186	mg/kg	95% UCL-T	Reg IV Guidance
Site	Benzo(a)anthracene	mg/kg	0.56	0.62	3.7	-	0.62	mg/kg	95% UCL-T	Reg IV Guidance
Site	Chrysene	mg/kg	0.49	0.59	4.0	-	0.59	mg/kg	95% UCL-T	Reg IV Guidance
Site	Benzo(b and/or k)fluoranthene	mg/kg	0.51	0.58	2.0	-	0.58	mg/kg	95% UCL-T	Reg IV Guidance
Site	Benzo-a-pyrene	mg/kg	0.48	0.51	1.8	-	0.51	mg/kg	95% UCL-T	Reg IV Guidance
Site	Indeno (1,2,3-cd) pyrene	mg/kg	0.45	0.45	0.30	J	0.30	mg/kg	Maximum	Reg IV Guidance

Footnotes:

1. Calculated using one-half the sample quantitation limit for non-detects. This explains how this statistic can be greater than the maximum detected value.
2. "-" is a result that did not require qualification.
3. 95% UCL of Log-transformed Data (95% UCL-T)

Table 3.2RME
Exposure Point Concentrations Summary
Reasonable Maximum Exposure
Chemfax, Inc. Superfund Site

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean [1]	95% UCL of Log-Transformed Data	Maximum Concentration/ Qualifier [2]		Exposure Point Concentration			
							Value	Units	Statistic [3]	Rationale
Well	Benzene	ug/L	1,770	NA	7,100	-	1,770	ug/l	Mean-N	Reg IV Guidance
Well	Ethyl Benzene	ug/L	1,007	NA	2,800	-	1,007	ug/l	Mean-N	Reg IV Guidance
Well	Methyl butyl ketone	ug/L	158	NA	460	-	158	ug/l	Mean-N	Reg IV Guidance
Well	Toluene	ug/L	395	NA	1,300	-	395	ug/l	Mean-N	Reg IV Guidance
Well	Total Xylenes	ug/L	1,222	NA	2,800	-	1,222	ug/l	Mean-N	Reg IV Guidance
Well	2-Methylnaphthalene	ug/L	46	NA	110	-	46	ug/l	Mean-N	Reg IV Guidance
Well	Bis(2-Chloroethyl) ether	ug/L	12	NA	38	J	12	ug/l	Mean-N	Reg IV Guidance
Well	Naphthalene	ug/L	511	NA	2,000	-	511	ug/l	Mean-N	Reg IV Guidance

Footnotes:

1. Calculated using one-half the sample quantitation limit for non-detects. This explains how this statistic can be greater than the maximum detected value.
2. "-" is a result that did not require qualification.
3. Mean of Normal Data (Mean-N)

Table 4.1RME | **Scenario Timeframe: Current/Future**
Values Used for Daily Intake Calculations | **Medium: Soil**
Chemfax, Inc. Superfund Site | **Exposure Medium: Soil**

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/Model Name
Ingestion	Trespasser/ Visitor	Adolescent	Process Area	CS	chemical concentration in soil	See Table 3	mg/kg	See Table 3	Chronic daily intake = CS x IR x CF x FI x EF x ED x 1/BW x 1/AT
				IR	ingestion rate	100	mg/day	EPA 1991a	
				CF	conversion factor	0.000001	kg/mg	--	
				FI	fraction ingested from source	1	unitless	Judgment	
				EF	exposure frequency	50	days/year	EPA 1991a	
				ED	exposure duration	10	years	EPA 1991a	
				BW	body weight	45	kg	EPA 1995	
				AT-C	averaging time (cancer)	25550	days	EPA 1989a	
				AT-N	averaging time (non-cancer)	3650	days	EPA 1989a	
Dermal	Trespasser/ Visitor	Adolescent	Process Area	CS	chemical concentration in soil	See Table 3	mg/kg	See Table 3	Chronic daily intake = CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
				SA	surface area	5800	cm^2	EPA 1997	
				AF	adherence factor	1	mg/cm^2	EPA 1995	
				ABS	absorption factor	Chem. Spec.	unitless	EPA 1995	
				EF	exposure frequency	50	days/year	EPA 1991a	
				ED	exposure duration	10	years	EPA 1991a	
				CF	conversion factor	0.000001	kg/mg	--	
				BW	body weight	45	kg	EPA 1995	
				AT-C	averaging time (cancer)	25550	days	EPA 1989a	
				AT-N	averaging time (non-cancer)	3650	days	EPA 1989a	
Inhalation	Trespasser/ Visitor	Adolescent	Process Area	CS	chemical concentration in soil	See Table 3	mg/kg	See Table 3	Chronic daily intake = CS x IN x ED x EF x (1/PEF) x 1/BW x 1/AT
				IN	inhalation rate	17	m^3/day	EPA 1997	
				PEF	particulate emissions factor	1.32E+09	m^3/kg	EPA 1991b	
				EF	exposure frequency	50	days/year	EPA 1991a	
				ED	exposure duration	10	years	EPA 1991a	
				BW	body weight	45	kg	EPA 1995	
				AT-C	averaging time (cancer)	25550	days	EPA 1989a	
				AT-N	averaging time (non-cancer)	3650	days	EPA 1989a	

U.S. EPA. 1989a. Risk Assessment Guidance for Superfund: Human Health Evaluation Manual (Part A) December. Appendix A.

U.S. EPA. 1991a. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors," OSWER Directive 9298.6-03, March 25.

U.S. EPA. 1991b. Human Health Evaluation Manual, Part B: Development of Risk-Based Preliminary Remediation Goals," OSWER Directive 9285.7-01B, December 13.

U.S. EPA. 1995. "Supplemental Guidance to RAGS: Region 4 Bulletins. Human Health Risk Assessment." November.

U.S. EPA. 1997. Exposure Factors Handbook, Volume 1, General Factors. Prepared by the Office of Research and Development. August.

Table 4.2RME
Values Used for Daily Intake Calculations
Chemfax, Inc. Superfund Site

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/Model Name
Ingestion	Worker	Adult	Process Area	CS	chemical concentration in soil	See Table 3	mg/kg	See Table 3	Chronic daily intake = CS x IR x CF x FI x EF x ED x 1/BW x 1/AT
				IR	ingestion rate	50	mg/day	EPA 1991a	
				CF	conversion factor	0.000001	kg/mg	–	
				FI	fraction ingested from source	1	unitless	Judgment	
				EF	exposure frequency	250	days/year	EPA 1991a	
				ED	exposure duration	25	years	EPA 1991a	
				BW	body weight	70	kg	EPA 1995	
				AT-C	averaging time (cancer)	25550	days	EPA 1989a	
				AT-N	averaging time (non-cancer)	9125	days	EPA 1989a	
Dermal	Worker	Adult	Process Area	CS	chemical concentration in soil	See Table 3	mg/kg	See Table 3	Chronic daily intake = CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
				SA	surface area	5800	cm^2	EPA 1997c	
				AF	adherence factor	1	mg/cm^2	EPA 1995	
				ABS	absorption factor	Chem. Spec.	unitless	EPA 1995	
				EF	exposure frequency	250	days/year	EPA 1991a	
				ED	exposure duration	25	years	EPA 1991a	
				CF	conversion factor	0.000001	kg/mg	–	
				BW	body weight	70	kg	EPA 1995	
				AT-C	averaging time (cancer)	25550	days	EPA 1989a	
				AT-N	averaging time (non-cancer)	9125	days	EPA 1989a	
Inhalation	Worker	Adult	Process Area	CS	chemical concentration in soil	See Table 3	mg/kg	See Table 3	Chronic daily intake = CS x IN x ED x EF x (1/PEF) x 1/BW x 1/AT
				IN	inhalation rate	20	m^3/day	EPA 1997c	
				PEF	particulate emissions factor	1.32E+09	m^3/kg	EPA 1991b	
				EF	exposure frequency	250	days/year	EPA 1991a	
				ED	exposure duration	25	years	EPA 1991a	
				BW	body weight	70	kg	EPA 1995	
				AT-C	averaging time (cancer)	25550	days	EPA 1989a	
				AT-N	averaging time (non-cancer)	9125	days	EPA 1989a	

U.S. EPA. 1989a. Risk Assessment Guidance for Superfund: Human Health Evaluation Manual (Part A) December. Appendix A.

U.S. EPA. 1991a. *Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors," OSWER Directive 9298.6-03, March 25.*

U.S. EPA. 1991b. Human Health Evaluation Manual, Part B: Development of Risk-Based Preliminary Remediation Goals," OSWER Directive 9285.7-01B, December 13.

U.S. EPA. 1995. "Supplemental Guidance to RAGS: Region 4 Bulletins. Human Health Risk Assessment." November.

U.S. EPA. 1997c. Exposure Factors Handbook, Volume 1, General Factors. Prepared by the Office of Research and Development. August.

Table 4.3RME
Values Used for Daily Intake Calculations
Chemfax, Inc. Superfund Site

Scenario Timeframe:Current/Future
Medium: Soil
Exposure Medium: Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/Model Name
Ingestion	Resident	Child	Process Area	CS	chemical concentration in soil	See Table 3	mg/kg	See Table 3	Chronic daily intake = CS x IR x CF x FI x EF x ED x 1/BW x 1/AT
				IR	ingestion rate	200	mg/day	EPA 1991a	
				CF	conversion factor	0.000001	kg/mg	–	
				FI	fraction ingested from source	1	unitless	Judgment	
				EF	exposure frequency	350	days/year	EPA 1991a	
				ED	exposure duration	6	years	EPA 1991a	
				BW	body weight	15	kg	EPA 1995	
				AT	averaging time (non-cancer)	2190	days	EPA 1989a	
Dermal	Resident	Child	Process Area	CS	chemical concentration in soil	See Table 3	mg/kg	See Table 3	Chronic daily intake = CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
				SA	surface area	2650	cm^2	EPA 1997c	
				AF	adherence factor	1	mg/cm^2	EPA 1995	
				ABS	absorption factor	Chem. Spec.	unitless	EPA 1995	
				EF	exposure frequency	350	days/year	EPA 1991a	
				ED	exposure duration	6	years	EPA 1991a	
				CF	conversion factor	0.000001	kg/mg	–	
				BW	body weight	15	kg	EPA 1995	
				AT	averaging time (non-cancer)	2190	days	EPA 1989a	
Inhalation	Resident	Child	Process Area	CS	chemical concentration in soil	See Table 3	mg/kg	See Table 3	Chronic daily intake = CS x IN x ED x EF x (1/PEF) x 1/BW x 1/AT
				IN	inhalation rate	10	m^3/day	EPA 1997c	
				PEF	particulate emissions factor	1.32E+09	m^3/kg	EPA 1991b	
				EF	exposure frequency	350	days/year	EPA 1991a	
				ED	exposure duration	6	years	EPA 1991a	
				BW	body weight	15	kg	EPA 1995	
				AT	averaging time (non-cancer)	2190	days	EPA 1989a	

U.S. EPA. 1989a. *Risk Assessment Guidance for Superfund: Human Health Evaluation Manual (Part A)* December. Appendix A.

U.S. EPA. 1991a. *Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors,"* OSWER Directive 9298.6-03, March 25.

U.S. EPA. 1991b. Human Health Evaluation Manual, Part B: Development of Risk-Based Preliminary Remediation Goals," OSWER Directive 9285.7-01B, December 13.

U.S. EPA. 1995. "Supplemental Guidance to RAGS: Region 4 Bulletins. Human Health Risk Assessment." November.

U.S. EPA. 1997c. Exposure Factors Handbook, Volume 1, General Factors. Prepared by the Office of Research and Development. August.

Table 4.4RME
Values Used for Daily Intake Calculations
Chemfax, Inc. Superfund Site

Scenario Timeframe:Current/Future
Medium: Soil
Exposure Medium: Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/Model Name
Ingestion	Resident	Child to Adult	Process Area	CS	chemical concentration in soil	See Table 3	mg/kg	See Table 3	Chronic daily intake = CS x IF x CF x FI x EF x 1/AT
				IF	ingestion factor	114	mg-yr/kg-day	EPA 1991b	
				CF	conversion factor	0.000001	kg/mg	–	
				FI	fraction ingested from source	1	unitless	Judgment	
				EF	exposure frequency	350	days/year	EPA 1991a	
				AT	averaging time (cancer)	25550	days	EPA 1989a	
Dermal	Resident	Child to Adult	Process Area	CS	chemical concentration in soil	See Table 3	mg/kg	See Table 3	Chronic daily intake = CS x CF x SA x AF x ABS x EF x 1/AT
				DF	dermal factor	3049	cm^2-yr/kg-day	EPA 1991b	
				AF	adherence factor	1	mg/cm^2	EPA 1995	
				EF	exposure frequency	350	days/year	EPA 1991a	
				ABS	absorption factor	Chem. Spec.	unitless	EPA 1995	
				CF	conversion factor	0.000001	kg/mg	–	
				AT	averaging time (cancer)	25550	days	EPA 1989a	
Inhalation	Resident	Child to Adult	Process Area	CS	chemical concentration in soil	See Table 3	mg/kg	See Table 3	Chronic daily intake = CS x IF x EF x (1/PEF) x 1/AT
				IF	inhalation factor	10.9	m^3-yr/kg-day	EPA 1991b	
				PEF	particulate emissions factor	1.32E+09	m^3/kg	EPA 1991b	
				EF	exposure frequency	350	days/year	EPA 1991a	
				AT	averaging time (cancer)	25550	days	EPA 1989a	

U.S. EPA. 1989a. Risk Assessment Guidance for Superfund: Human Health Evaluation Manual (Part A) December. Appendix A.

U.S. EPA. 1991a. *Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors,"* OSWER *Directive* 9298.6-03, March 25.

U.S. EPA. 1991b. Human Health Evaluation Manual, Part B: Development of Risk-Based Preliminary Remediation Goals," OSWER Directive 9285.7-01B, December 13.

U.S. EPA. 1995. "Supplemental Guidance to RAGS: Region 4 Bulletins. Human Health Risk Assessment." November.

Table 4.5RME
Values Used for Daily Intake Calculations
Chemfax, Inc. Superfund Site

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/Model Name
Ingestion	Resident	Child	Well	CW	chemical concentration in water	See Table 3	ug/l	See Table 3	Chronic daily intake = CW x IR x EF x ED x CF x 1/BW x 1/AT
				IR	ingestion rate	1	liters/day	EPA 1991a	
				EF	exposure frequency	350	days/year	EPA 1991a	
				ED	exposure duration	6	years	EPA 1991a	
				CF	conversion factor	0.001	mg/ug	EPA 1991a	
				BW	body weight	15	kg	EPA 1991a	
				AT	averaging time (non-cancer)	2190	days	EPA 1989a	
Inhalation	Resident	Child	Well	CW	chemical concentration in water	See Table 3	ug/l	See Table 3	Chronic daily intake = CW x NIEE x EF x ED x CF x 1/BW x 1/AT
				NIEE	non-ingestion exposure rate	1	liters/day	EPA 1991c	
				EF	exposure frequency	350	days/year	EPA 1991a	
				ED	exposure duration	6	years	EPA 1991a	
				CF	conversion factor	0.001	mg/ug	EPA 1991a	
				BW	body weight	15	kg	EPA 1991a	
				AT	averaging time (non-cancer)	2190	days	EPA 1989a	

U.S. EPA. 1989a. Risk Assessment Guidance for Superfund: Human Health Evaluation Manual (Part A) December. Appendix A.

U.S. EPA. 1991a. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors," OSWER Directive 9298.6-03, March 25.

Table 4.6RME
Values Used for Daily Intake Calculations
Chemfax, Inc. Superfund Site

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/Model Name
Ingestion	Resident	Child to Adult	Well	CW	chemical concentration in water	See Table 3	ug/l	See Table 3	Chronic daily intake (mg/kg-day) = CW x IF x EF x CF x 1/AT
				IF	ingestion factor	1.09	liters-yr/kg-day	EPA 1991a, b	
				EF	exposure frequency	350	days/year	EPA 1991a	
				CF	conversion factor	0.001	mg/ug	--	
				AT	averaging time (cancer)	25550	days	EPA 1991a	
Inhalation	Resident	Child to Adult	Well	CW	chemical concentration in water	See Table 3	ug/l	See Table 3	Chronic daily intake (mg/kg-day) = CW x IF x EF x CF x 1/AT
				IF	ingestion factor	1.09	liters-yr/kg-day	EPA 1991a, b, c	
				EF	exposure frequency	350	days/year	EPA 1991a	
				CF	conversion factor	0.001	mg/ug	--	
				AT	averaging time (cancer)	25550	days	EPA 1991a	

U.S. EPA. 1991a. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors," OSWER Directive 9298.6-03, March 25.

U.S. EPA. 1991b. Human Health Evaluation Manual, Part B: Development of Risk-Based Preliminary Remediation Goals," OSWER Directive 9285.7-01B, December 13.

U.S. EPA. 1991c. "Guidance on Estimating Exposure to VOCs During Showering," Office of Research and Development. July 10.

Table 4.7RME
Values Used for Daily Intake Calculations
Chemfax, Inc. Superfund Site

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/Model Name
Ingestion	Worker	Adult	Well	CW	chemical concentration in water	See Table 3	ug/l	See Table 3	Chronic daily intake = CW x IR x EF x ED x CF x 1/BW x 1/AT
				IR	ingestion rate	1	liters/day	EPA 1991	
				EF	*exposure frequency*	250	days/year	EPA 1991	
				ED	exposure duration	25	years	EPA 1991	
				CF	conversion factor	0.001	mg/ug	EPA 1991	
				BW	body weight	70	kg	EPA 1991	
				AT-C	*averaging time (cancer)*	25550	days	EPA 1989	
				AT-N	averaging time (non-cancer)	9125	days	EPA 1989	

U.S. EPA. 1989. Risk Assessment Guidance for Superfund: Human Health Evaluation Manual (Part A) December. Appendix A.

U.S. EPA. 1991. *Human Health Evaluation Manual, Supplemental Guidance*: "Standard Default Exposure Factors," OSWER *Directive* 9298.6-03, March 25.

Table 5.1
Non-Cancer Toxicity Data -- Oral/Dermal
Chemfax, Inc. Superfund Site

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Absorption Efficiency (for Dermal)[1]	Dermal RfD [2,3]		Primary Target Organ(s)	Combined Uncertainty/ Modifying Factors	RfD: Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s)
Aluminum	Chronic	1E+00	mg/kg/day	20%	2E-01	mg/kg/day	Not specified	unk	NCEA	unk
Antimony	Chronic	4E-04	mg/kg/day	20%	8E-05	mg/kg/day	Blood chemistry	1000	IRIS	2/1/91
Arsenic	Chronic	3E-04	mg/kg/day	100%	3E-04	mg/kg/day	Skin (Hyperpigmentation, keratosis)	3	IRIS	4/10/98
Benzo(a)anthracene	Chronic	NA	mg/kg/day	100%	NA	mg/kg/day	NA	NA	IRIS	5/5/98
Benzo(a)pyrene	Chronic	NA	mg/kg/day	100%	NA	mg/kg/day	NA	NA	IRIS	5/5/98
Benzo(b and/or k)fluoranthene	Chronic	NA	mg/kg/day	100%	NA	mg/kg/day	NA	NA	IRIS	5/5/98
Chromium	Chronic	5E-03	mg/kg/day	2%	1E-04	mg/kg/day	No adverse effect	900	IRIS	9/3/98
Chrysene	Chronic	NA	mg/kg/day	100%	NA	mg/kg/day	NA	NA	IRIS	5/5/98
Indeno(1,2,3-cd)pyrene	Chronic	NA	mg/kg/day	100%	NA	mg/kg/day	NA	NA	IRIS	5/5/98
Iron	Chronic	3E-01	mg/kg/day	20%	6E-02	mg/kg/day	No adverse effect	1	NCEA	1999
Benzene	Chronic	1E-03	mg/kg/day	100%	1E-03	mg/kg/day	Bone marrow	100	NCEA	1998
Ethyl Benzene	Chronic	1E-01	mg/kg/day	100%	1E-01	mg/kg/day	Liver and kidney toxiciy	1000	IRIS	6/1/91
Methyl butyl ketone	Chronic	4E-02	mg/kg/day	100%	4E-02	mg/kg/day	Not specified	NA	NCEA	unk
Toluene	Chronic	2E-01	mg/kg/day	100%	2E-01	mg/kg/day	Changes in liver, kidney weights	1000	IRIS	8/1/90
Total Xylenes	Chronic	2E+00	mg/kg/day	100%	2E+00	mg/kg/day	Hyperactivity, decreased body weight	100	IRIS	9/30/87
2-Methylnaphthalene	Chronic	2E-02	mg/kg/day	100%	2E-02	mg/kg/day	Not specified	NA	NCEA	unk
Bis(2-Chloroethyl) ether	Chronic	NA	mg/kg/day	100%	NA	mg/kg/day	NA	NA	IRIS	10/1/91
Naphthalene	Chronic	2E-02	mg/kg/day	100%	2E-02	mg/kg/day	Decreased mean terminal body weight	3000	IRIS	9/17/98

Notes:

1. ATSDR toxicological profiles consulted. When absorption efficiency exceeded 50% in the toxicological profile, EPA Region IV policy is to default to 100% (EPA 1999d). Where no data were available, the following defaults were used: 20% Inorganics, 50% semivolatiles, 80% volatiles.
2. EPA 1989a. Risk Assessment Guidance for Superfund: Human Health Evaluation Manual (Part A) December. Appendix A.
3. Equation used for derivation: RfD x oral to dermal adjustment factor

Acronyms:
ATSDR - Agency for Toxic Substances and Disease Registry
IRIS - Integrated Risk Information System
HEAST - Health Effects Assessment Summary Tables
NCEA - National Center for Environmental Assessment
RfD - Reference dose
unk - Unknown
NA - Not applicable

Table 5.2
Non-Cancer Toxicity Data -- Inhalation
Chemfax, Inc. Superfund Site

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Adjusted RfD [1]		Primary Target Organ	Combined Uncertainty/ Modifying Factors	RfC: Target Organ(s)	
		Values	Units	Values	Units			Source(s)	Date(s)
Benzene	Chronic	9E-03	mg/m^3	2.6E-03	mg/kg/day	Bone marrow	1000	NCEA	1998
Chromium	Chronic	1E-04	mg/m^3	2.9E-05	mg/kg/day	Lung	300	IRIS	9/3/98
Ethyl Benzene	Chronic	1E+00	mg/m^3	2.9E-01	mg/kg/day	Lung	300	IRIS	3/1/91
Methyl butyl ketone	Chronic	unk	unk	1.4E-03	mg/kg/day	Unknown	unk	NCEA	unk
Toluene	Chronic	4E-01	mg/m^3	1.1E-01	mg/kg/day	CNS	300	IRIS	8/1/92

Notes:

1. Equation used for derivation: RfC divided by 70 kg (assumed human body weight) multiplied by 20 m^3/day (assumed human intake rate).

Acronyms:

IRIS - Integrated Risk Information System

HEAST - Health Effects Assessment Summary Tables

NCEA - National Center for Environmental Assessment

RfD - Reference dose

RfC - Reference concentration

CNS - Central nervous system

unk - Unknown

Table 6.1
Cancer Toxicity Data – Oral/Dermal
Chemfax, Inc. Superfund Site

Chemical of Potential Concern	Oral Cancer Slope Factor		Absorption Efficiency (for Dermal)	Adjusted Cancer Slope Factor (for Dermal) [1,2]		Weight of Evidence/ Cancer Guideline Description [4,5]	Oral CSF: Absorption Efficiency	
	Value	Units		Value	Units		Source(s)	Date(s)
Aluminum	NA	(mg/kg/day)-1	20%	NA	(mg/kg/day)-1	D	NA	NA
Antimony	NA	(mg/kg/day)-1	1%	NA	(mg/kg/day)-1	NE	IRIS	2/1/91
Arsenic	1.5E+00	(mg/kg/day)-1	100%	1.5E+00	(mg/kg/day)-1	A	IRIS	4/10/98
Benzo(a)anthracene	7.3E-01	(mg/kg/day)-1	100%	7.3E-01	(mg/kg/day)-1	B2	NCEA	unk
Benzo(a)pyrene	7.3E+00	(mg/kg/day)-1	100%	7.3E+00	(mg/kg/day)-1	B2	IRIS	5/5/98
Benzo(b and/or k)fluoranthene	7.3E-01	(mg/kg/day)-1	100%	7.3E-01	(mg/kg/day)-1	B2	NCEA	unk
Chromium	NA	(mg/kg/day)-1	2%	NA	(mg/kg/day)-1	D	IRIS	9/3/98
Chrysene	7.3E-03	(mg/kg/day)-1	100%	7.3E-03	(mg/kg/day)-1	B2	NCEA	unk
Indeno(1,2,3-cd)pyrene	7.3E-01	(mg/kg/day)-1	100%	7.3E-01	(mg/kg/day)-1	B2	NCEA	unk
Iron	NA	(mg/kg/day)-1	100%	NA	(mg/kg/day)-1	D	NA	NA
Benzene	2.9E-02	(mg/kg/day)-1	100%	2.9E-02	(mg/kg/day)-1	A	IRIS	10/16/98
Ethyl Benzene	NA	(mg/kg/day)-1	100%	NA	(mg/kg/day)-1	D	NA	NA
Methyl butyl ketone	NA	(mg/kg/day)-1	100%	NA	(mg/kg/day)-1	D	NA	NA
Toluene	NA	(mg/kg/day)-1	100%	NA	(mg/kg/day)-1	D	NA	NA
Total Xylenes	NA	(mg/kg/day)-1	100%	NA	(mg/kg/day)-1	D	NA	NA
2-Methylnaphthalene	NA	(mg/kg/day)-1	100%	NA	(mg/kg/day)-1	D	NA	NA
Bis(2-Chloroethyl) ether	1.1E+00	(mg/kg/day)-1	100%	1.1E+00	(mg/kg/day)-1	B2	IRIS	2/1/94
Naphthalene	NA	(mg/kg/day)-1	100%	NA	(mg/kg/day)-1	D	NA	NA

Notes:

1. ATSDR toxicological profiles consulted. When absorption efficiency exceeded 50% in the toxicological profile, EPA Region IV policy is to default to 100% (EPA 1999d). Where no data were available, the following defaults were used: 20% inorganics, 50% semivolatiles, 80% volatiles.
2. EPA 1989a. Risk Assessment Guidance for Superfund: Human Health Evaluation Manual (Part A) December. Appendix A.
3. Equation used for derivation: CSF divided by oral to dermal adjustment factor
4. Weight of Evidence:
   Known/Likely
   Cannot be Determined
   Not Likely
5. EPA Group:
   A - Human carcinogen
   B1 - Probable human carcinogen - indicates that limited human data are available
   B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
   C - Possible human carcinogen
   D - Not classifiable as a human carcinogen
   E - Evidence of noncarcinogenicity
   NE - Not evaluated

Acronyms:
ATSDR - Agency for Toxic Substances and Disease Registry
IRIS - Integrated Risk Information System
HEAST - Health Effects Assessment Summary Tables
NCEA - National Center for Environmental Assessment
CSF - Cancer Slope Factor
unk - Unknown
NA - Not applicable

Table 6.2
Cancer Toxicity Data -- Inhalation
Chemfax, Inc. Superfund Site

Chemical of Potential Concern	Unit Risk		Adjustment [1]	Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description [2,3]	Source(s)	Date(s)
	Value	Units		Value	Units			
Arsenic	4.3E-03	ug/m^3	3.5.E+03	1.5E+01	$(mg/kg/day)^{-1}$	A	IRIS	4/10/98
Benzo(a)anthracene	unk	ug/m^3	unk	3.1E-01	$(mg/kg/day)^{-1}$	B2	NCEA	unk
Benzo(a)pyrene	unk	ug/m^3	unk	3.1E+00	$(mg/kg/day)^{-1}$	B2	NCEA	unk
Benzo(b and/or k)fluoranthene	unk	ug/m^3	unk	3.1E-01	$(mg/kg/day)^{-1}$	B2	NCEA	unk
Chromium	1.2E-02	ug/m^3	3.5.E+03	4.2E+01	$(mg/kg/day)^{-1}$	A	IRIS	09/03/98
Chrysene	unk	ug/m^3	unk	3.1E-03	$(mg/kg/day)^{-1}$	B2	NCEA	unk
Indeno(1,2,3-cd)pyrene	unk	ug/m^3	unk	3.1E-01	$(mg/kg/day)^{-1}$	B2	NCEA	unk
Benzene	7.8E-06	ug/m^3	3.5.E+03	2.7E-02	$(mg/kg/day)^{-1}$	A	IRIS	10/16/98
Bis(2-Chloroethyl) ether	3.3E-04	ug/m^3	3.5.E+03	1.2E+00	$(mg/kg/day)^{-1}$	B2	IRIS	2/1/94

Notes:

1. Adjustment: 70 kg (assumed human body weight) divided by 20 m^3/day (assumed human intake rate) multiplied by 1,000 ug/mg.

2. Weight of Evidence:
   Known/Likely
   Cannot be Determined
   Not Likely
3. EPA Group:
   A - Human carcinogen
   B1 - Probable human carcinogen - indicates that limited human data are available
   B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
   C - Possible human carcinogen
   D - Not classifiable as a human carcinogen
   E - Evidence of noncarcinogenicity
   W - Withdrawn; Agency position pending

Acronyms:

ATSDR - Agency for Toxic Substances and Disease Registry

IRIS - Integrated Risk Information System

HEAST - Health Effects Assessment Summary Tables

NCEA - National Center for Environmental Assessment

unk - Unknown

Table 9.1RME
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Chemfax, Inc. Superfund Site

Scenario Timeframe: Current/Future
Receptor Population: Visitor/Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Chemical of Potential Concern	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Soil	Site	Aluminum	NA	NA	NA	NA	Aluminum	Not specified	0.003	0.001	NA	0.004
			Antimony	NA	NA	NA	NA	Antimony	Blood chemistry	0.002	0.0005	NA	0.002
			Arsenic	3E-07	2E-08	4E-10	3E-07	Arsenic	Skin (Hyperpigmentation, keratosis)	0.01	0.0003	NA	0.01
			Chromium	NA	NA	2E-08	2E-08	Chromium	No adverse effect	0.005	0.02	0.0001	0.02
			Iron	NA	NA	NA	NA	Iron	No adverse effect	0.02	0.01	NA	0.03
			Benzo(a)anthracene	2E-08	1E-08	1E-12	3E-08	Benzo(a)anthracene	NA	NA	NA	NA	NA
			Chrysene	2E-10	9E-11	9E-15	2E-10	Chrysene	NA	NA	NA	NA	NA
			Benzo(b and/or k)fluoranthene	2E-08	9E-09	9E-13	3E-08	Benzo(b and/or k)fluoranthene	NA	NA	NA	NA	NA
			Benzo-a-pyrene	2E-07	9E-08	8E-12	2E-07	Benzo-a-pyrene	NA	NA	NA	NA	NA
			Indeno (1,2,3-cd) pyrene	1E-08	8E-09	8E-13	2E-08	Indeno (1,2,3-cd) pyrene	NA	NA	NA	NA	NA
			Total	*5E-07*	*1E-07*	*2E-08*	*7E-07*		**Total**	*0.04*	*0.02*	*0.0001*	*0.1*

Total Risk Across All Media and All Exposure Routes 7E-07

Total Hazard Index Across All Media and All Exposure Routes 0.1

Conclusions:

1. The excess cancer risk level is below EPA's acceptable range (10-4 and 10-6).
2. The hazard index is less than one, indicating non-cancer effects are not likely.

Table 9.2RME
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Chemfax, Inc. Superfund Site

Scenario Timeframe: Future
Receptor Population: Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Chemical of Potential Concern	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Soil	Site	Aluminum	NA	NA	NA	NA	Aluminum	Not specified	0.005	0.003	NA	0.01
			Antimony	NA	NA	NA	NA	*Antimony*	*Blood chemistry*	0.003	0.002	NA	0.004
			Arsenic	1E-06	2E-07	4E-09	1E-06	Arsenic	Skin (Hyperpigmentation, keratosis)	0.01	0.001	NA	0.01
			Chromium	NA	NA	2E-07	2E-07	Chromium	No adverse effect	0.01	0.05	0.0005	0.1
			Iron	NA	NA	NA	NA	Iron	No adverse effect	0.03	0.02	NA	0.05
			Benzo(a)anthracene	7E-08	8E-08	9E-12	2E-07	Benzo(a)anthracene	NA	NA	NA	NA	NA
			Chrysene	6E-10	7E-10	8E-14	1E-09	Chrysene	NA	NA	NA	NA	NA
			Benzo(b and/or k)fluoranthene	6E-08	8E-08	8E-12	1E-07	Benzo(b and/or k)fluoranthene	NA	NA	NA	NA	NA
			Benzo-a-pyrene	6E-07	7E-07	8E-11	1E-06	*Benzo-a-pyrene*	NA	NA	NA	NA	NA
			Indeno (1,2,3-cd) pyrene	6E-08	7E-08	7E-12	1E-07	Indeno (1,2,3-cd) pyrene	NA	NA	NA	NA	NA
			Total	**2E-06**	**1E-06**	**2E-07**	**3E-06**		**Total**	**0.1**	**0.1**	**0.0005**	**0.1**
Ground-water	Ground-water	Well	Benzene	2E-04	NA	NA	2E-04	Benzene	Bone marrow	17	NA	NA	17
			Ethyl Benzene	NA	NA	NA	NA	Ethyl Benzene	Liver and kidney toxiciy	0.1	NA	NA	0.1
			Methyl butyl ketone	NA	NA	NA	NA	Methyl butyl ketone	Not specified	0.04	NA	NA	0.04
			Toluene	NA	NA	NA	NA	Toluene	Changes in liver, kidney weights	0.02	NA	NA	0.02
			Total Xylenes	NA	NA	NA	NA	*Total Xylenes*	*Hyperactivity, decreased body weigh*	*0.01*	NA	NA	*0.01*
			2-Methylnaphthalene	NA	NA	NA	NA	2-Methylnaphthalene	Not specified	0.02	NA	NA	0.02
			Bis(2-Chloroethyl) ether	4E-05	NA	NA	4E-05	Bis(2-Chloroethyl) ether	NA	NA	NA	NA	NA
			Naphthalene	NA	NA	NA	NA	Naphthalene	Decreased mean terminal body weig	0.2	NA	NA	0.2
			Total	**2E-04**	**NA**	**NA**	**2E-04**		**Total**	**18**	**NA**	**NA**	**18**

Total Risk Across All Media and All Exposure Routes | **2E-04**

Total Hazard Index Across All Media and All Exposure Routes | **18**

Total Bone Marrow Hazard Index Across All Media and All Exposure Routes | **17**

Conclusions:

1. The excess cancer risk level is above EPA's acceptable range (10-4 and 10-6).
2. The hazard index is less than one, indicating non-cancer effects are not expected.

Table 9.3RME
Summary of Receptor Hazards for COPCs
Reasonable Maximum Exposure
Chemfax, Inc. Superfund Site

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Non-Carcinogenic Hazard Quotient				
				Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Soil	Site	Aluminum	Not specified	0.1	0.01	NA	0.1
			Antimony	Blood chemistry	0.1	0.005	NA	0.1
			Arsenic	Skin (Hyperpigmentation, keratosis)	0.2	0.003	NA	0.2
			Chromium	No adverse effect	0.2	0.2	0.002	0.4
			Iron	No adverse effect	0.9	0.1	NA	0.9
			Benzo(a)anthracene	NA	NA	NA	NA	NA
			Chrysene	NA	NA	NA	NA	NA
			Benzo(b and/or k)fluoranthene	NA	NA	NA	NA	NA
			Benzo-a-pyrene	NA	NA	NA	NA	NA
			Indeno (1,2,3-cd) pyrene	NA	NA	NA	NA	NA
				Total	2	0.2	0.002	2
Ground-water	Ground-water	Well	Benzene	Bone marrow	113	NA	44	157
			Ethyl Benzene	Liver and kidney toxiciy	0.6	NA	0.2	0.9
			Methyl butyl ketone	Not specified	0.3	NA	7	7
			Toluene	Changes in liver, kidney weights	0.1	NA	0.2	0.3
			Total Xylenes	Hyperactivity, decreased body weight	0.04	NA	NA	0.04
			2-Methylnaphthalene	Not specified	0.1	NA	NA	0.1
			Bis(2-Chloroethyl) ether	NA	NA	NA	NA	NA
			Naphthalene	Decreased mean terminal body weight	2	NA	NA	2
				Total	116	NA	52	168

Total Hazard Index Across All Media and All Exposure Routes	**169**
Total Bone Marrow Hazard Index Across All Media and All Exposure Routes	**157**
Total Liver/Kidney Hazard Index Across All Media and All Exposure Routes	**1**
Total Decreased Body Weight Hazard Index Across All Media and All Exposure Routes	**2**

Conclusion:

The hazard index is greater than one, indicating non-cancer effects are possible.

Table 9.4RME
Summary of Receptor Risks for COPCs
Reasonable Maximum Exposure
Chemfax, Inc. Superfund Site

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child to Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk			
				Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Soil	Site	Aluminum	NA	NA	NA	NA
			Antimony	NA	NA	NA	NA
			Arsenic	1E-05	3E-07	9E-09	1E-05
			Chromium	NA	NA	4E-07	4E-07
			Iron	NA	NA	NA	NA
			Benzo(a)anthracene	6E-07	2E-07	2E-11	8E-07
			Chrysene	6E-09	2E-09	2E-13	7E-09
			Benzo(b and/or k)fluoranthene	6E-07	2E-07	2E-11	7E-07
			Benzo-a-pyrene	6E-06	1E-06	2E-10	7E-06
			Indeno (1,2,3-cd) pyrene	5E-07	1E-07	2E-11	7E-07
			Total	**2E-05**	**2E-06**	**4E-07**	**2E-05**
Ground-water	Ground-water	Well	Benzene	8E-04	NA	7E-04	1E-03
			Ethyl Benzene	NA	NA	NA	NA
			Methyl butyl ketone	NA	NA	NA	NA
			Toluene	NA	NA	NA	NA
			Total Xylenes	NA	NA	NA	NA
			2-Methylnaphthalene	NA	NA	NA	NA
			Bis(2-Chloroethyl) ether	2E-04	NA	2E-04	4E-04
			Naphthalene	NA	NA	NA	NA
			Total	**1E-03**	**NA**	**9E-04**	**2E-03**

Total Risk Across All Media and All Exposure Routes **2E-03**

Conclusions:

The excess cancer risk level is above EPA's acceptable range (10-4 and 10-6).

Table 10.2RME
Risk Assessment Summary
Reasonable Maximum Exposure
Chemfax, Inc. Superfund Site

Scenario Timeframe: Future
Receptor Population: Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				Chemical of Concern	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Soil	Site	Arsenic	1E-06	2E-07	4E-09	1E-06	Arsenic	Skin (Hyperpigmentation, keratosis)	0.01	0.001	NA	0.01
			Benzo-a-pyrene	6E-07	7E-07	8E-11	1E-06	Benzo-a-pyrene	NA	NA	NA	NA	NA
			Total	2E-06	9E-07	4E-09	3E-06		Total	0.01	0.001	NA	0.01
Ground-water	Ground-water	Well	Benzene	2E-04	NA	NA	2E-04	Benzene	Bone marrow	17	NA	NA	17
			Bis(2-Chloroethyl) ether	4E-05	NA	NA	4E-05	Bis(2-Chloroethyl) ether	NA	NA	NA	NA	NA
			Total	2E-04	NA	NA	2E-04		Total	17	NA	NA	17

Total Risk Across All Media and All Exposure Routes: 2E-04

Total Hazard Index Across All Media and All Exposure Routes: 17

Table 10.3RME
Risk Assessment Summary
Reasonable Maximum Exposure
Chemfax, Inc. Superfund Site

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemicals of Concern	Non-Carcinogenic Hazard Quotient				
				Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Soil	Site	Aluminum	Not specified	0.1	0.01	NA	0.1
			Antimony	Blood chemistry	0.1	0.005	NA	0.1
			Arsenic	Skin (Hyperpigmentation, keratosis)	0.2	0.003	NA	0.2
			Chromium	No adverse effect	0.2	0.2	0.002	0.4
			Iron	No adverse effect	0.9	0.1	NA	0.9
				Total	**2**	**0.2**	**0.002**	**2**
Ground-water	Ground-water	Well	Benzene	Bone marrow	113	NA	44	157
			Ethyl Benzene	Liver and kidney toxiciy	0.6	NA	0.2	0.9
			Methyl butyl ketone	Not specified	0.3	NA	7	7
			Toluene	Changes in liver, kidney weights	0.1	NA	0.2	0.3
			2-Methylnaphthalene	Not specified	0.1	NA	NA	0.1
			Naphthalene	Decreased mean terminal body weight	2	NA	NA	2
				Total	**116**	**NA**	**52**	**168**

Total Hazard Index Across All Media and All Exposure Routes **169**

Table 10.4RME
Risk Assessment Summary
Reasonable Maximum Exposure
Chemfax, Inc. Superfund Site

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child to Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Soil	Site	Arsenic	1E-05	3E-07	9E-09	1E-05
			Benzo-a-pyrene	6E-06	1E-06	2E-10	7E-06
			Total	**2E-05**	**2E-06**	**9E-09**	**2E-05**
Ground-water	Ground-water	Well	Benzene	8E-04	NA	7E-04	1E-03
			Bis(2-Chloroethyl) ether	2E-04	NA	2E-04	4E-04
			Total	**1E-03**	**NA**	**9E-04**	**2E-03**

Total Risk Across All Media and All Exposure Routes | **2E-03**

Table 11.1
Risk-Based Remedial Goal Options for Surface Soil
Commercial/Industrial Land Use Assumptions
Chemfax, Inc. Superfund Site

Chemicals of Concern	Detections [1] mg/kg		Cancer Risk Level [2] mg/kg			Hazard Quotient Level [2] mg/kg		
	Min	Max	1E-6	1E-5	1E-4	HQ = 0.1	HQ = 1	HQ = 3
Arsenic	3.1	7.2	3	34	341	55	549	1,648
Benzo(a)pyrene	0.058	1.8	0.4	4	36	NA	NA	NA

Notes:

1. Minimum/maximum detected concentration.
2. Remediation goals based on oral, inhalation, and dermal contact using Commercial/Industrial land use exposure assumptions.

Acronyms:

NA: Not applicable

HQ: Hazard quotient (noncancer risk)

Table 11.2
Risk-Based Remedial Goal Options for Surface Soil
Residential Land Use Assumptions
Chemfax, Inc. Superfund Site

Chemicals of Concern	Detections[1] mg/kg		Cancer Risk Level[2] mg/kg			Hazard Quotient Level[3] mg/kg		
	Min	Max	1E-6	1E-5	1E-4	HQ = 0.1	HQ = 1	HQ = 3
Aluminum	2,000	18,000	NA	NA	NA	7,335	73,355	220,064
Antimony	1.2	7.4	NA	NA	NA	3	29	88
Arsenic	3.1	7.2	0.4	4	42	2	23	69
Chromium	2.9	470	210	2,105	21,048	23	234	703
Iron	1,200	51,000	NA	NA	NA	2,201	22,006	66,019
Benzo(a)pyrene	0.058	1.8	0.1	1	7	NA	NA	NA

Notes:

1. Minimum/maximum detected concentration.

2. Remediation goals based on oral, inhalation, and dermal contact using Lifetime Resident land use exposure assumptions.

3. Remediation goals based on oral, inhalation, and dermal contact using Child Resident land use exposure assumptions.

Acronyms:

NA: *Not applicable*

HQ: *Hazard quotient (noncancer risk)*

Table 11.3
Risk-Based Remedial Goal Options and ARARs for Groundwater
Residential Land Use Assumptions
Chemfax, Inc. Superfund Site

Chemicals of Concern	Detections [1] (ug/l)		Cancer Risk Level [2] (ug/l)			Hazard Quotient Level [3] (ug/l)			MCLs [4] (ug/l)
	Min	Max	1E-6	1E-5	1E-4	HQ=0.1	HQ=1	HQ=3	EPA
Benzene	52	7,100	1	12	119	4	40	121	5
Ethyl Benzene	22	2,800	NA	NA	NA	116	1,159	3,476	700
Methyl butyl ketone	460	460	NA	NA	NA	2	21	63	NA
Toluene	5	1,300	NA	NA	NA	114	1,138	3,413	1,000
2-Methylnaphthalene	4	110	NA	NA	NA	31	313	939	NA
Bis(2-Chloroethyl) ether	38	38	0.03	0.3	3	NA	NA	NA	NA
Naphthalene	4	2,000	NA	NA	NA	31	313	939	NA

Notes:

1. Minimum/maximum average detected concentration in monitor well 2A, and DPT points 3, 5, 6, and 11.

2. Remediation goals based on ingestion of groundwater using Lifetime Resident Exposure Assumptions

3. Remediation goals based on ingestion of groundwater using Child Resident land use exposure assumptions.

The combination of Lifetime Resident exposure assumptions for carcinogens and Child Resident exposure assumptions for non-carcinogens results in the lowest (most protective) risk-based concentrations.

4. MCLs: U.S. EPA Maximum Contaminant Levels

Acronyms:

NA: Not applicable

HQ: Hazard quotient (noncancer risk)

Table 11.4
Risk-Based Remedial Goal Options and ARARs for Groundwater
Commercial/Industrial Land Use Assumptions
Chemfax, Inc. Superfund Site

Chemicals of Concern	Detections[1] (ug/l)		Cancer Risk Level[2] (ug/l)			Hazard Quotient Level[2] (ug/l)			MCLs[3] (ug/l)
	Min	Max	1E-6	1E-5	1E-4	HQ=0.1	HQ=1	HQ=3	EPA
Benzene	52	7,100	10	99	987	10	102	307	5
Bis(2-Chloroethyl) ether	38	38	0.3	3	26	NA	NA	NA	NA

Notes:

1. Minimum/maximum average detected concentration in monitor well 2A, and DPT points 3, 5, 6, and 11.
2. Remediation goals based on ingestion of groundwater using Commercial/Industrial land use exposure assumptions.
3. MCLs: U.S. EPA Maximum Contaminant Levels

Acronyms:
HQ: Hazard quotient (noncancer risk)
NA: Not applicable

APPENDIX D

FIGURES 2-8 & 2-13, TAKEN FROM THE FOLLOWING:

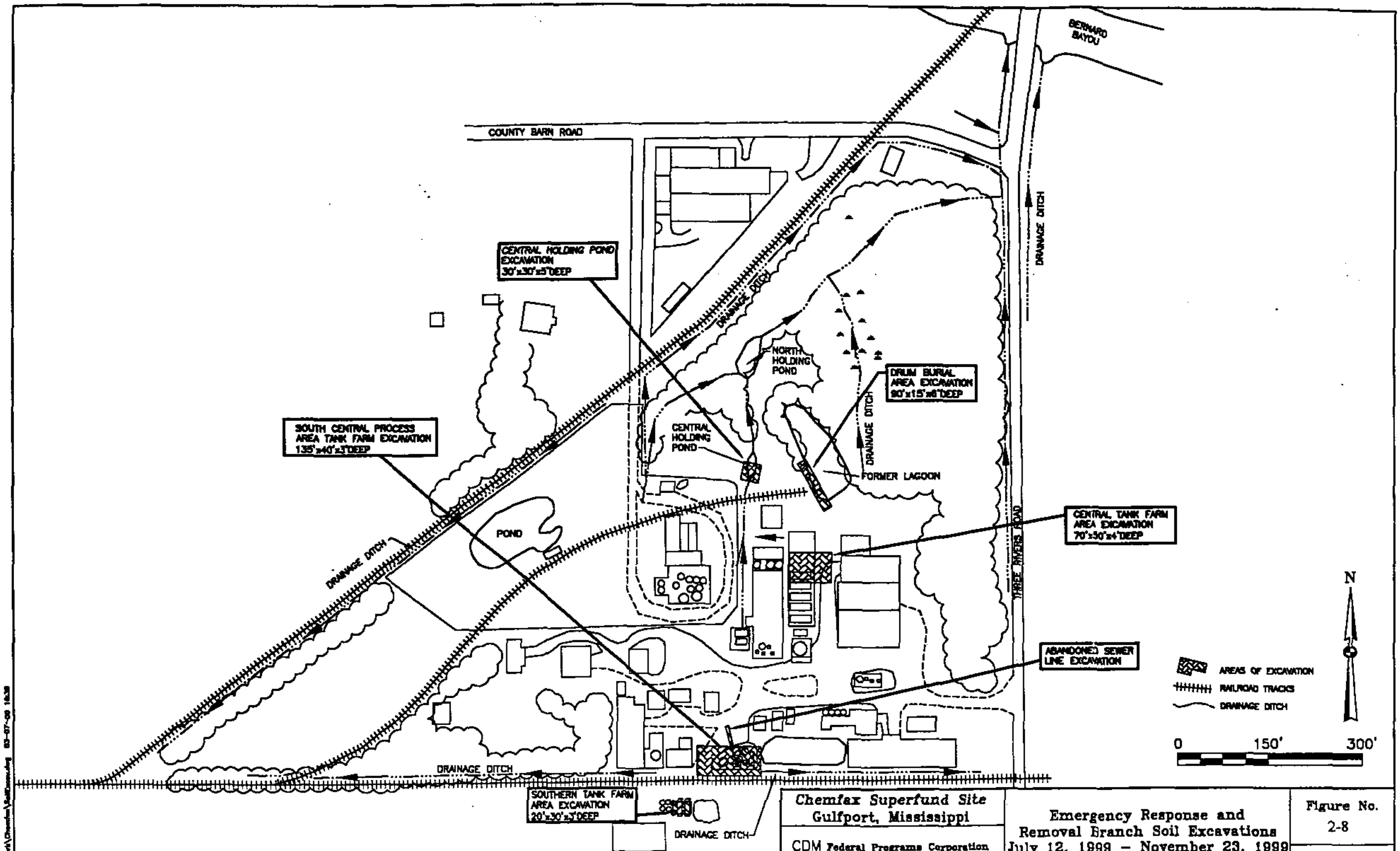
Final Feasibility Study Report for the Chemfax, Inc. Site, dated April 18, 2000.

29 FIGURES & TABLES 4-19, 4-20 TAKEN FROM THE FOLLOWING:

Final Report for the In-House Remedial Investigation at the Chemfax, Inc. Superfund Site, dated January, 1996.

PARTIAL SET OF FIGURES TAKEN FROM THE FOLLOWING:

Supplemental Groundwater Characterization Report, dated March, 1999. Note: Figures 1-1, 2-3, and 2-8 can be found in the Record of Decision.



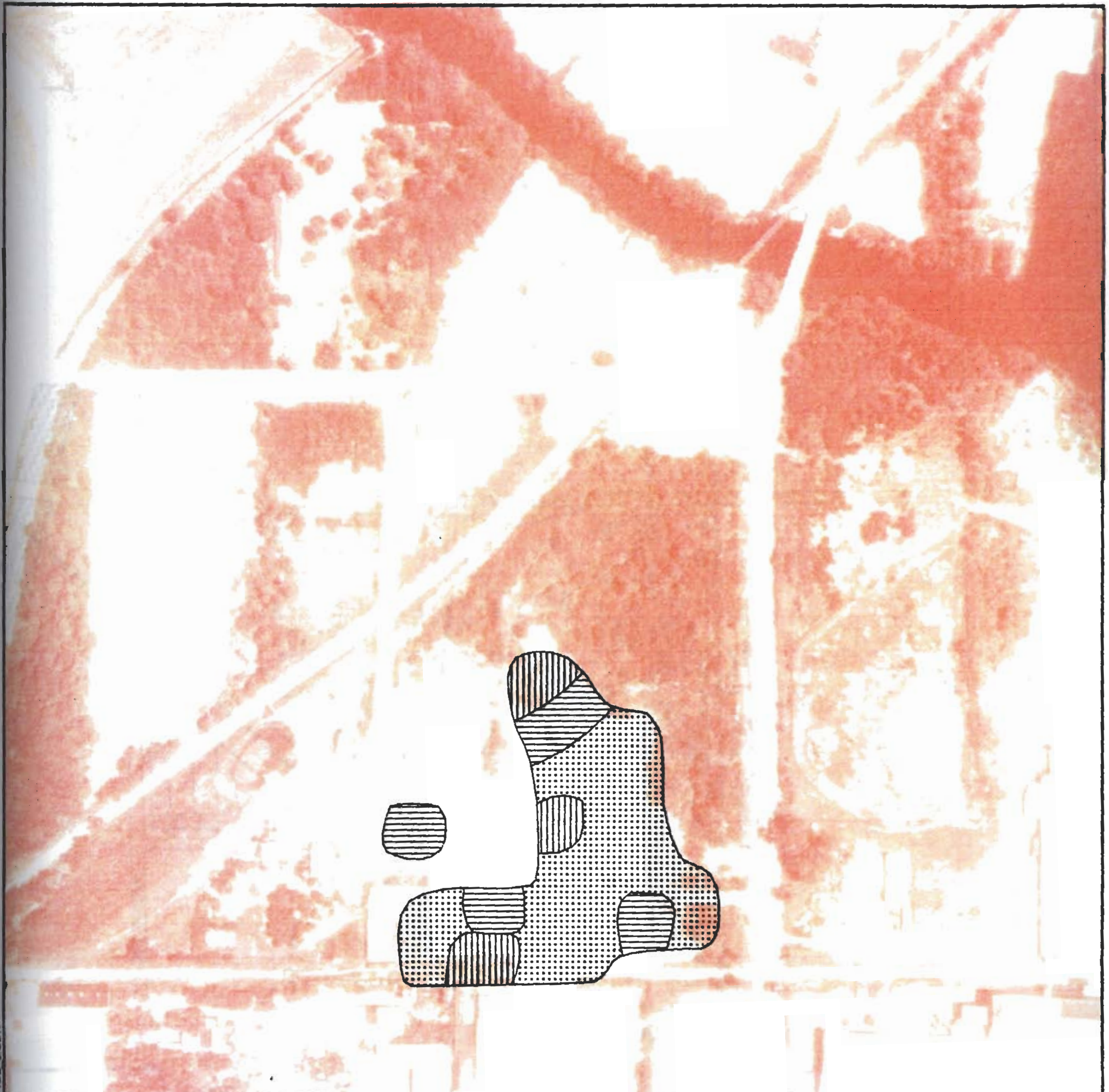
Chemfax Superfund Site
Gulfport, Mississippi

CDM Federal Programs Corporation

Emergency Response and Removal Branch Soil Excavations
July 12, 1999 – November 23, 1999

Figure No. 2-8

3/00



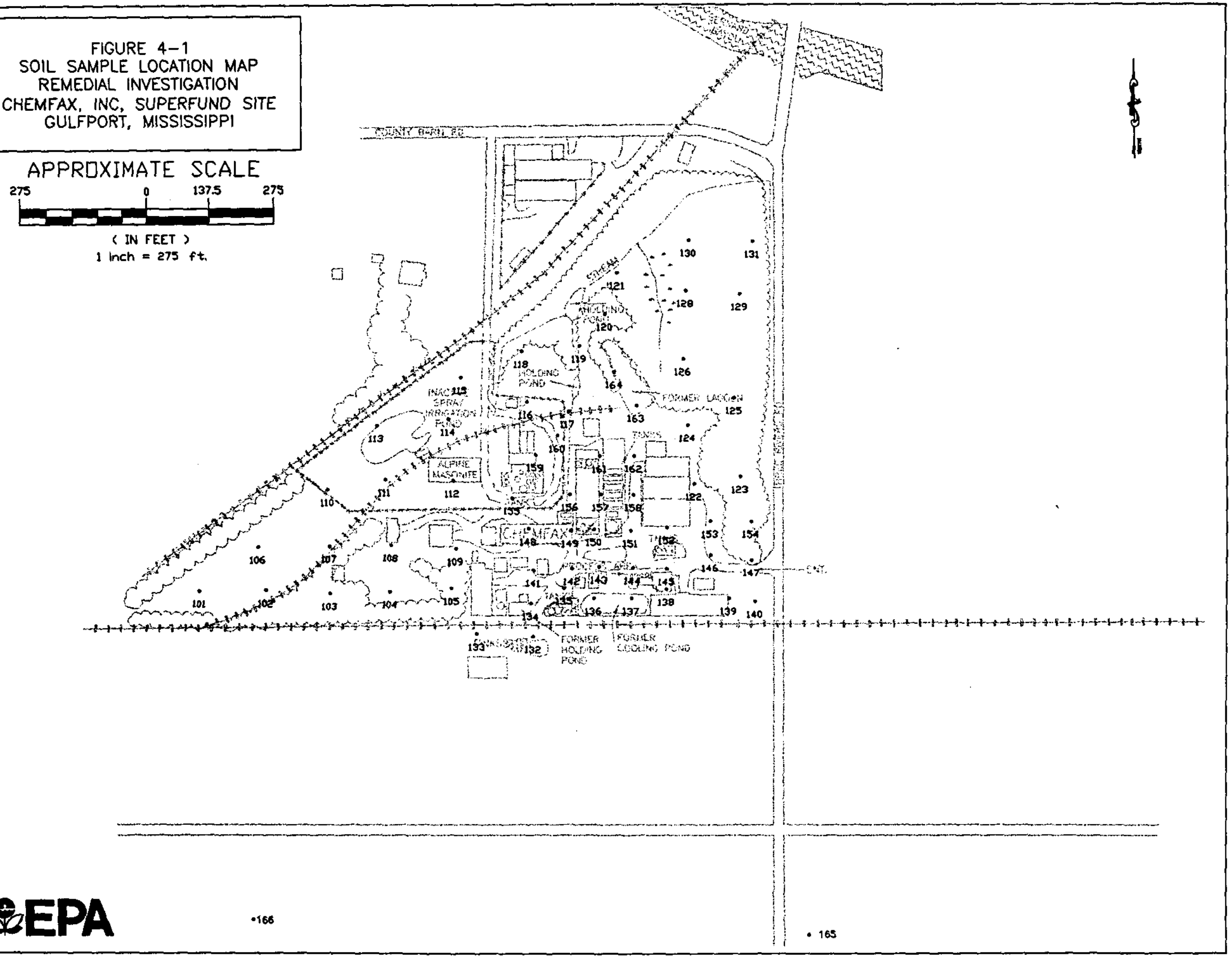
Legend

- 0-1ft bls
- 0-3 ft bls
- 0-6 ft bls

Figure 2-13

Extent of Soil Potentially Requiring
Further Attention for Protection of Groundwater
Feasibility Study
ChemFax, Inc.
Gulfport, Mississippi

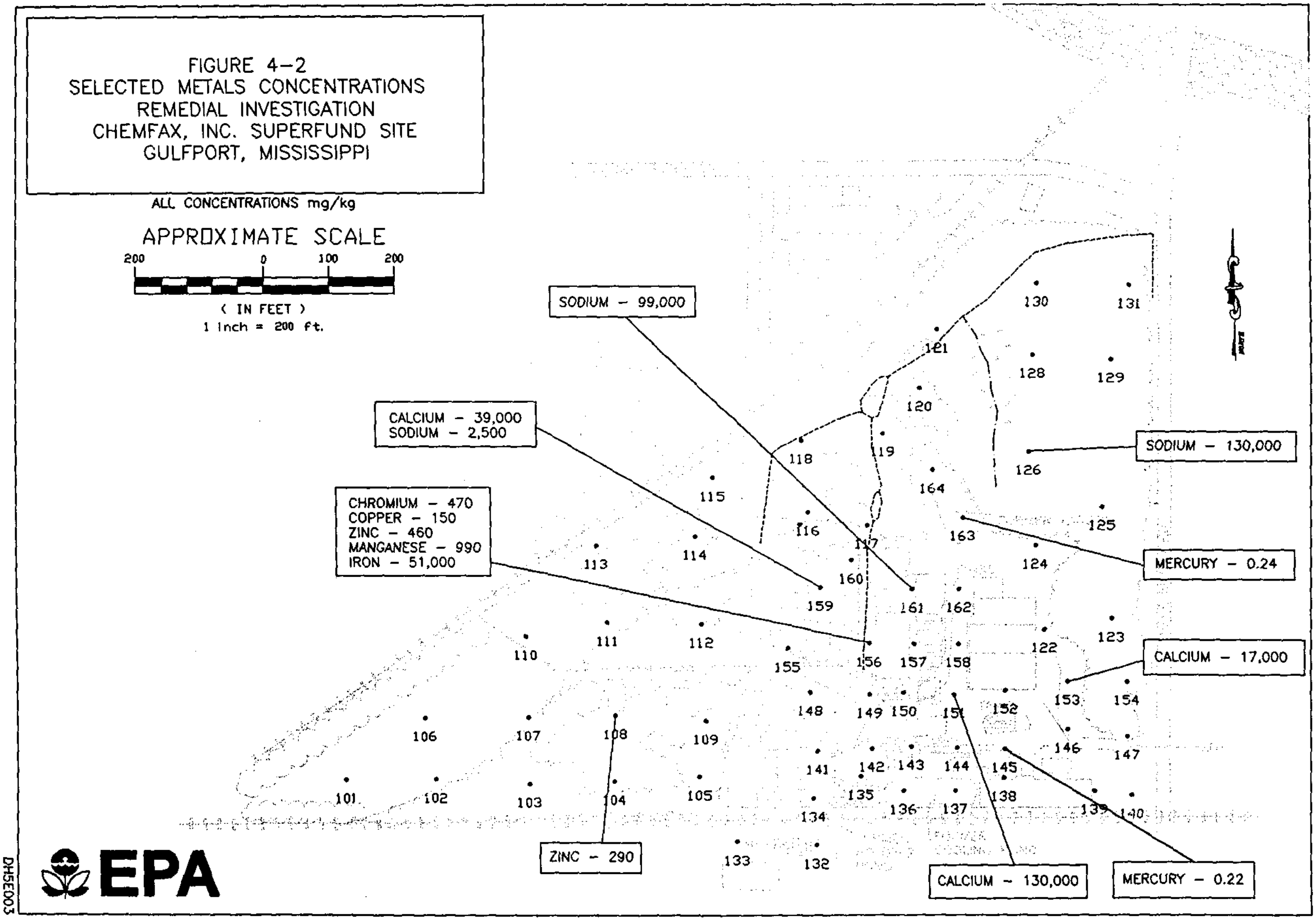
FIGURE 4–1
SOIL SAMPLE LOCATION MAP
REMEDIAL INVESTIGATION
CHEMFAX, INC, SUPERFUND SITE
GULFPORT, MISSISSIPPI



EPA

DHSE003C/0795

FIGURE 4-2
SELECTED METALS CONCENTRATIONS
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI



DH5E003

FIGURE 4–3
BENZENE CONTOURS
SURFACE SOIL
REGION IV IN–HOUSE
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI

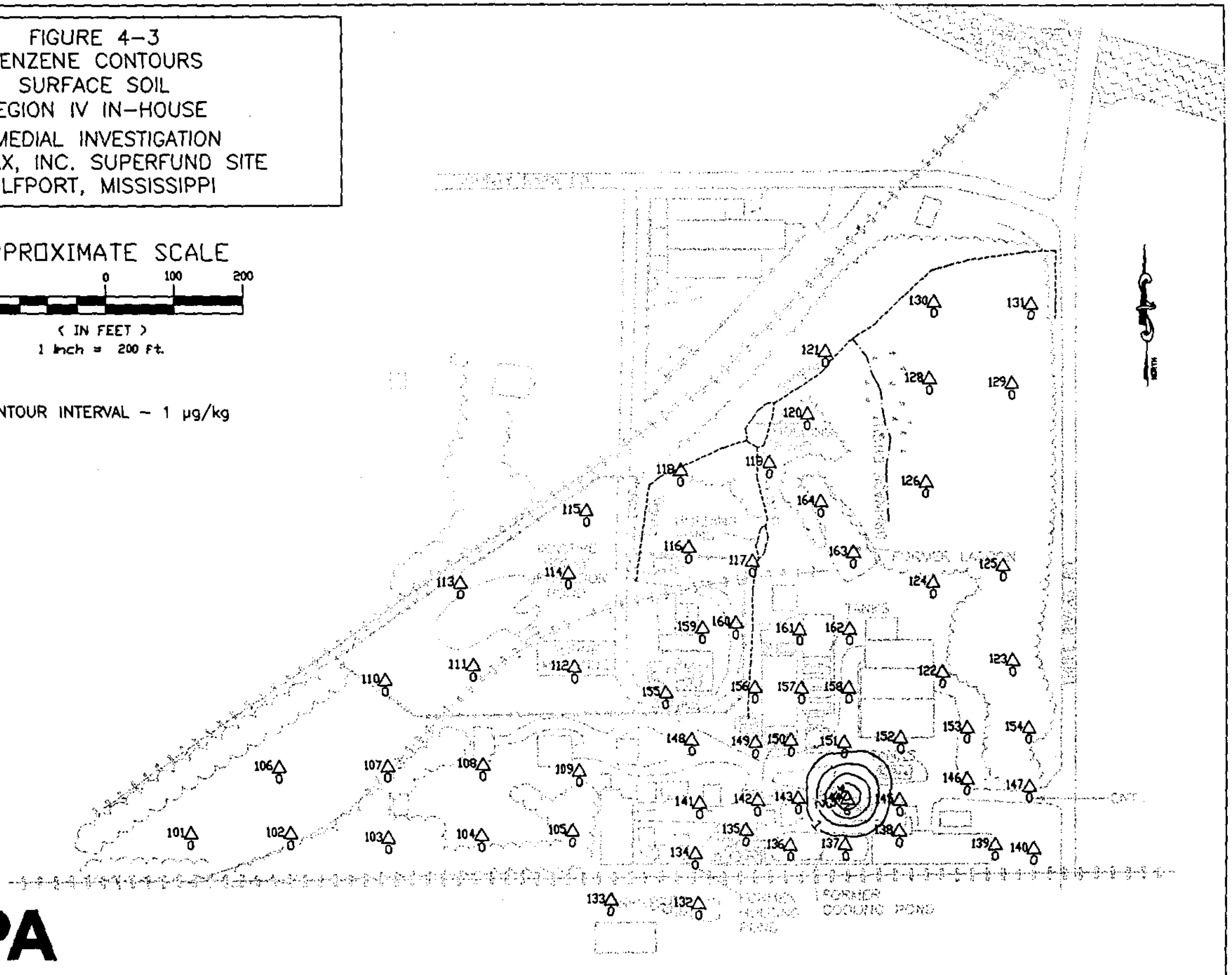
APPROXIMATE SCALE

200 0 100 200

(IN FEET)

1 inch = 200 Ft.

CONTOUR INTERVAL – 1 μg/kg



EPA

DH5E003B

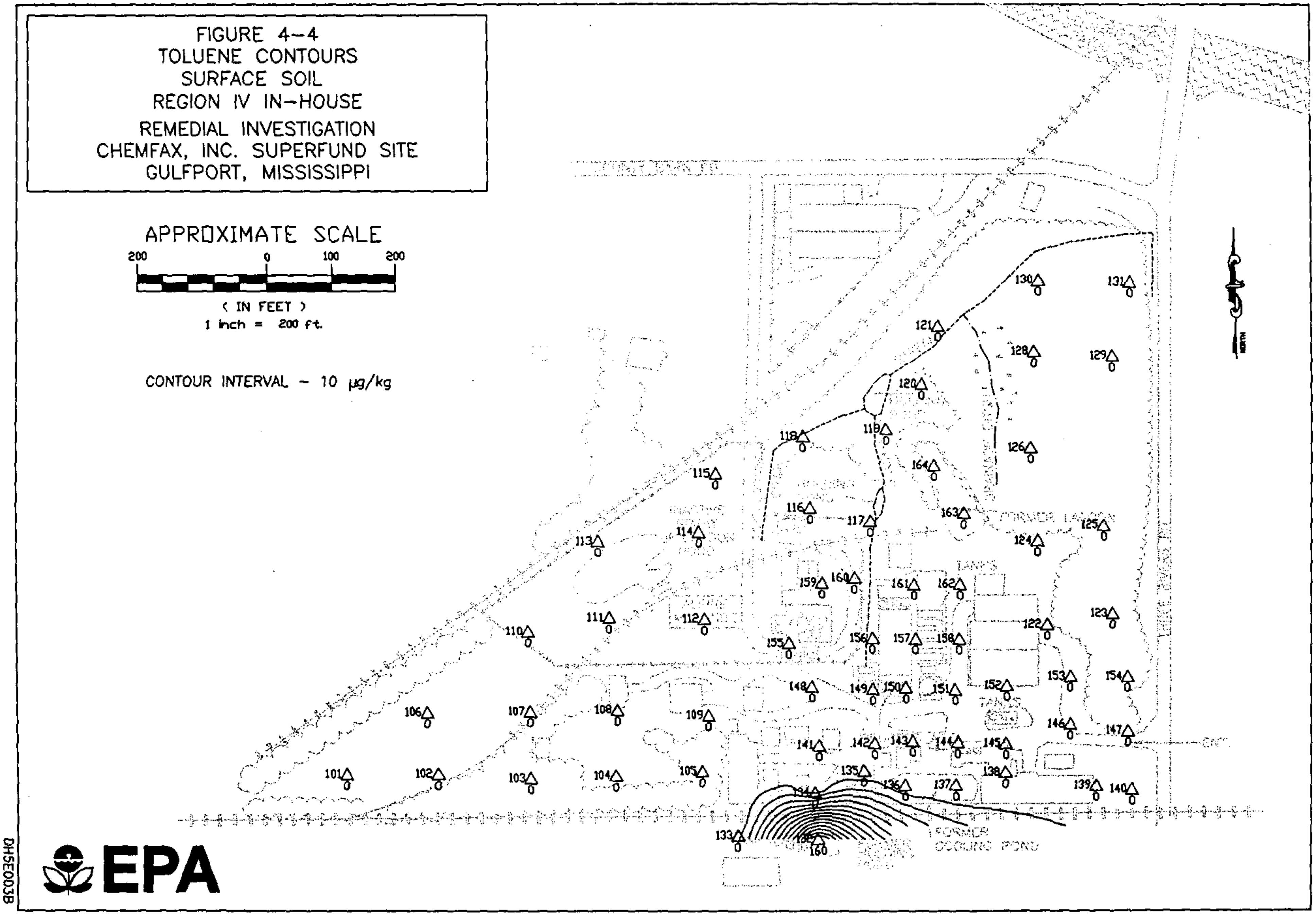


FIGURE 4-4
TOLUENE CONTOURS
SURFACE SOIL
REGION IV IN-HOUSE
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI

DH5E003B

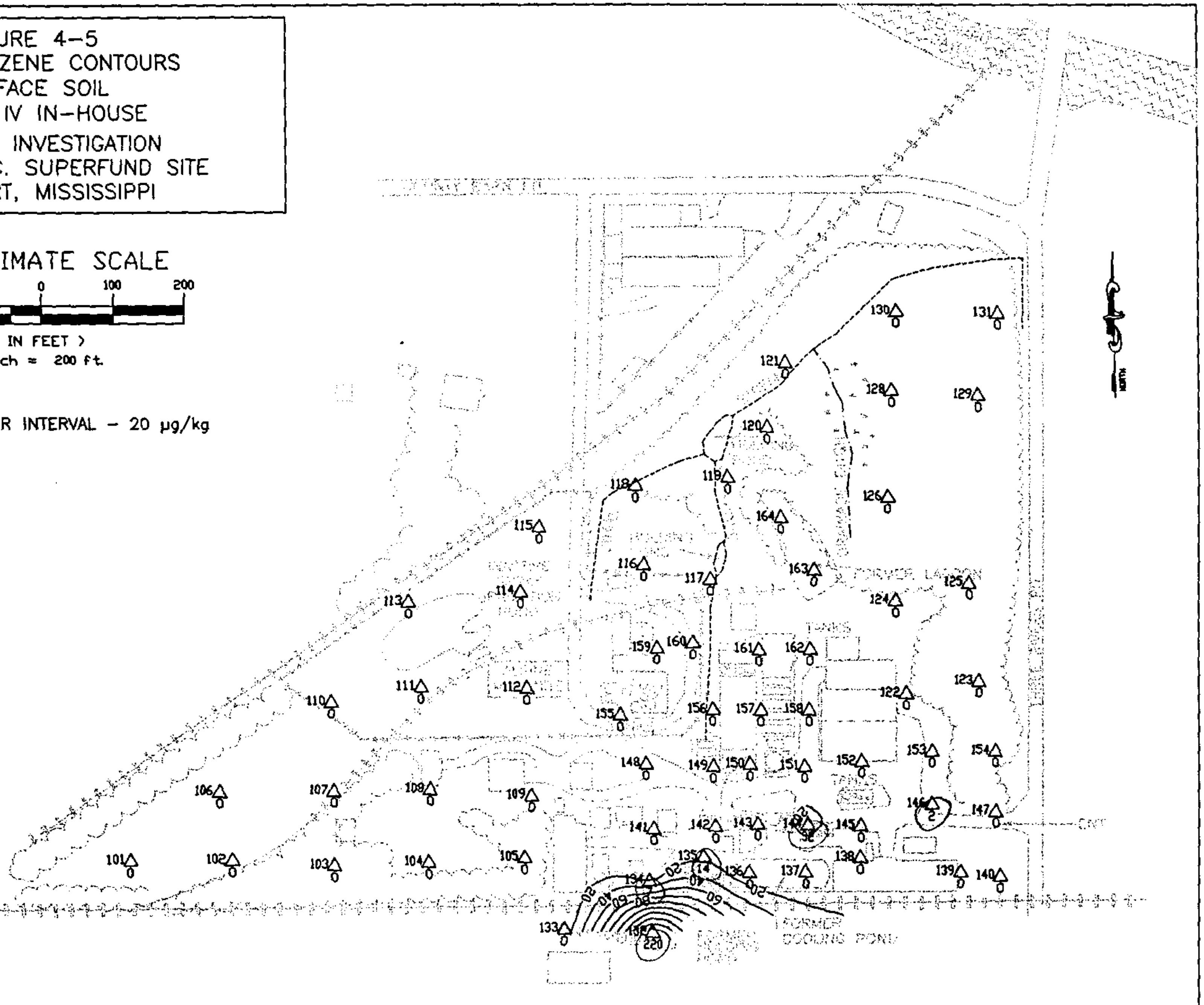
FIGURE 4-5
ETHYL BENZENE CONTOURS
SURFACE SOIL
REGION IV IN-HOUSE
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI

APPROXIMATE SCALE

200 0 100 200

(IN FEET)
1 inch = 200 ft.

CONTOUR INTERVAL - 20 µg/kg



EPA

DH5E003B

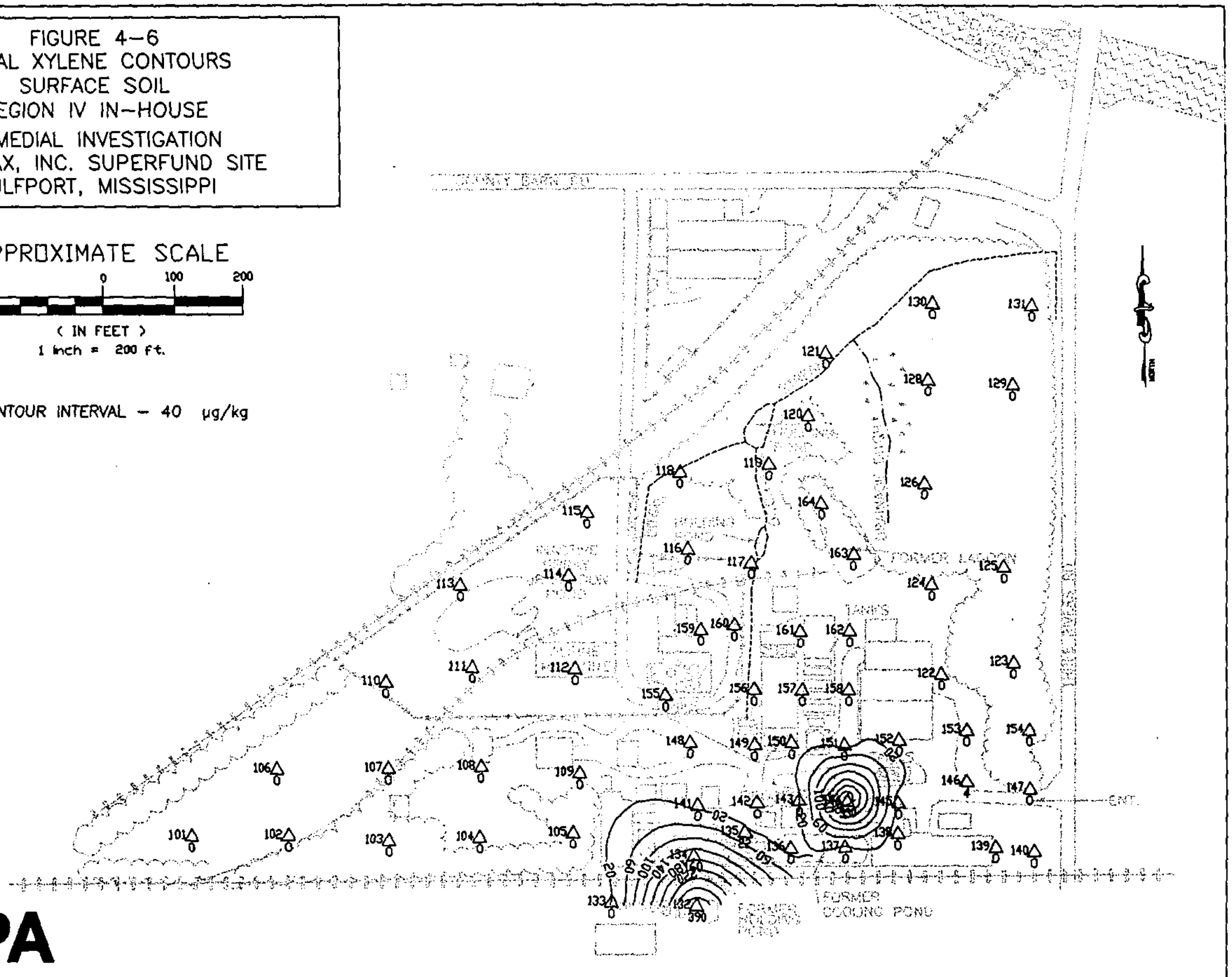
FIGURE 4–6
TOTAL XYLENE CONTOURS
SURFACE SOIL
REGION IV IN–HOUSE
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI

APPROXIMATE SCALE

200 0 100 200

(IN FEET)
1 inch = 200 ft.

CONTOUR INTERVAL – 40 μg/kg



EPA

DH5E003B

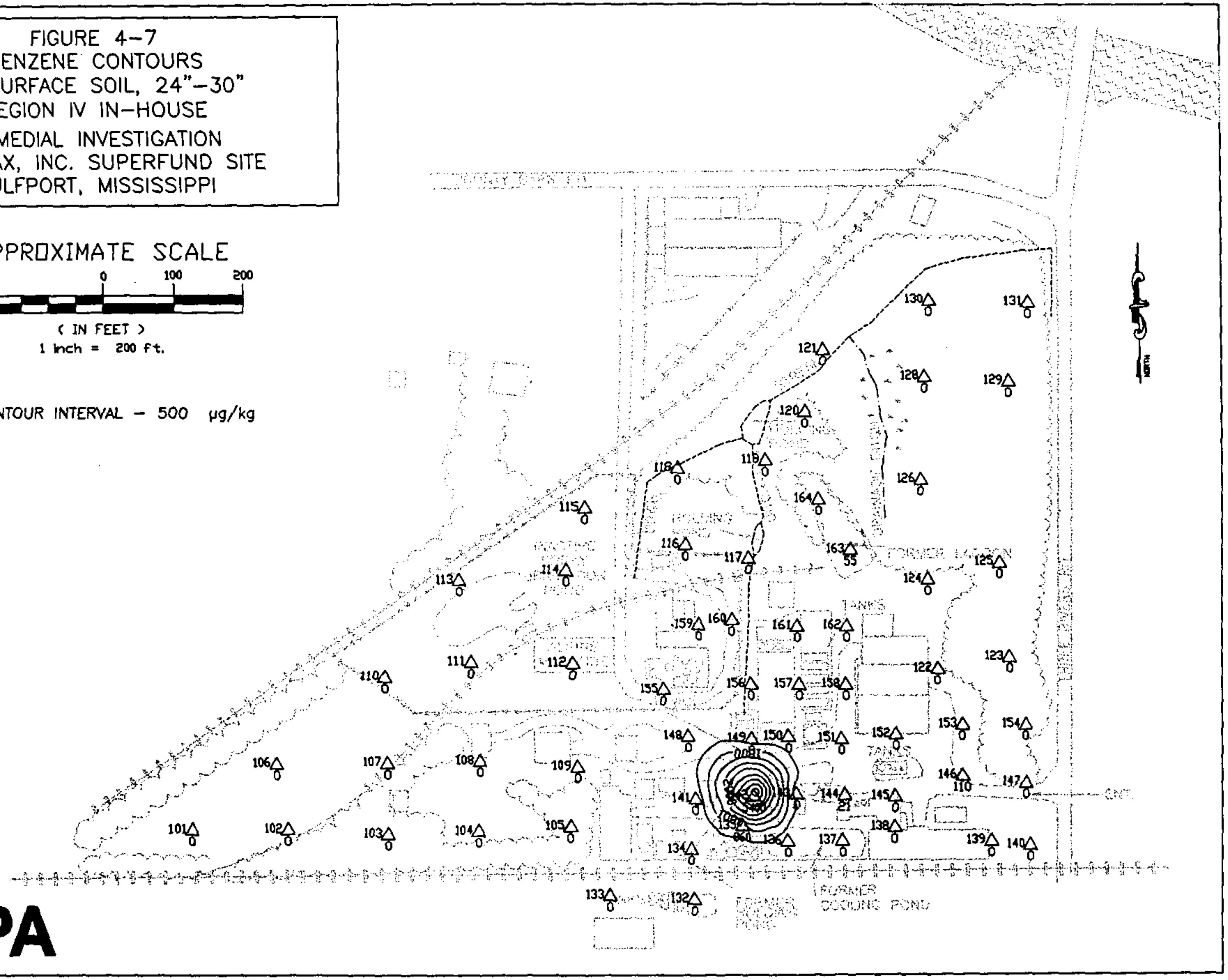
FIGURE 4-7
BENZENE CONTOURS
SUBSURFACE SOIL, 24"-30"
REGION IV IN-HOUSE
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI

APPROXIMATE SCALE

200 0 100 200

(IN FEET)
1 inch = 200 ft.

CONTOUR INTERVAL - 500 µg/kg



EPA

DH5E003B

FIGURE 4-8
TOLUENE CONTOURS
SUBSURFACE SOIL, 24"-30"
REGION IV IN-HOUSE
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI

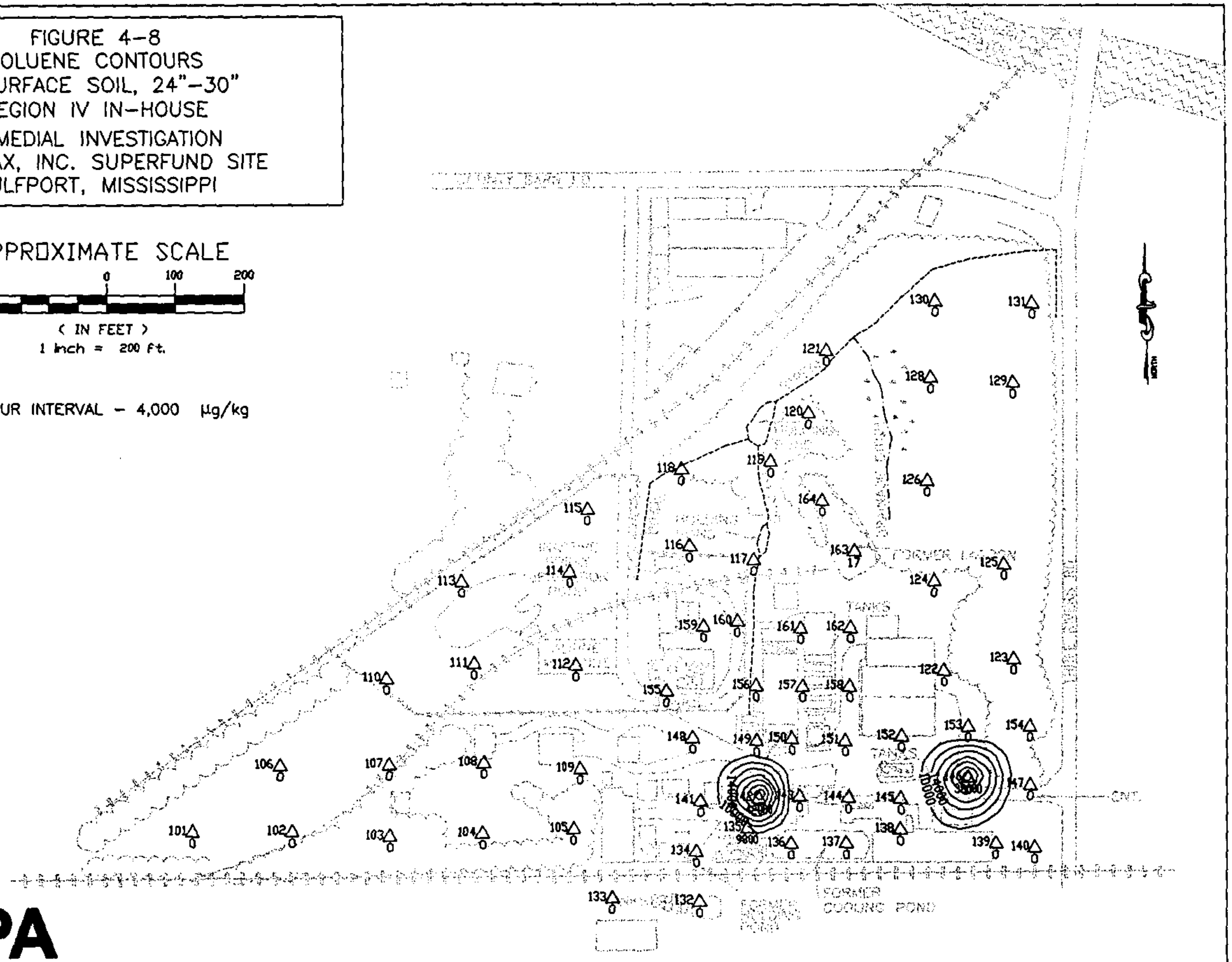
APPROXIMATE SCALE

200 0 100 200

(IN FEET)

1 inch = 200 ft.

CONTOUR INTERVAL - 4,000 µg/kg



EPA

DH5E003B

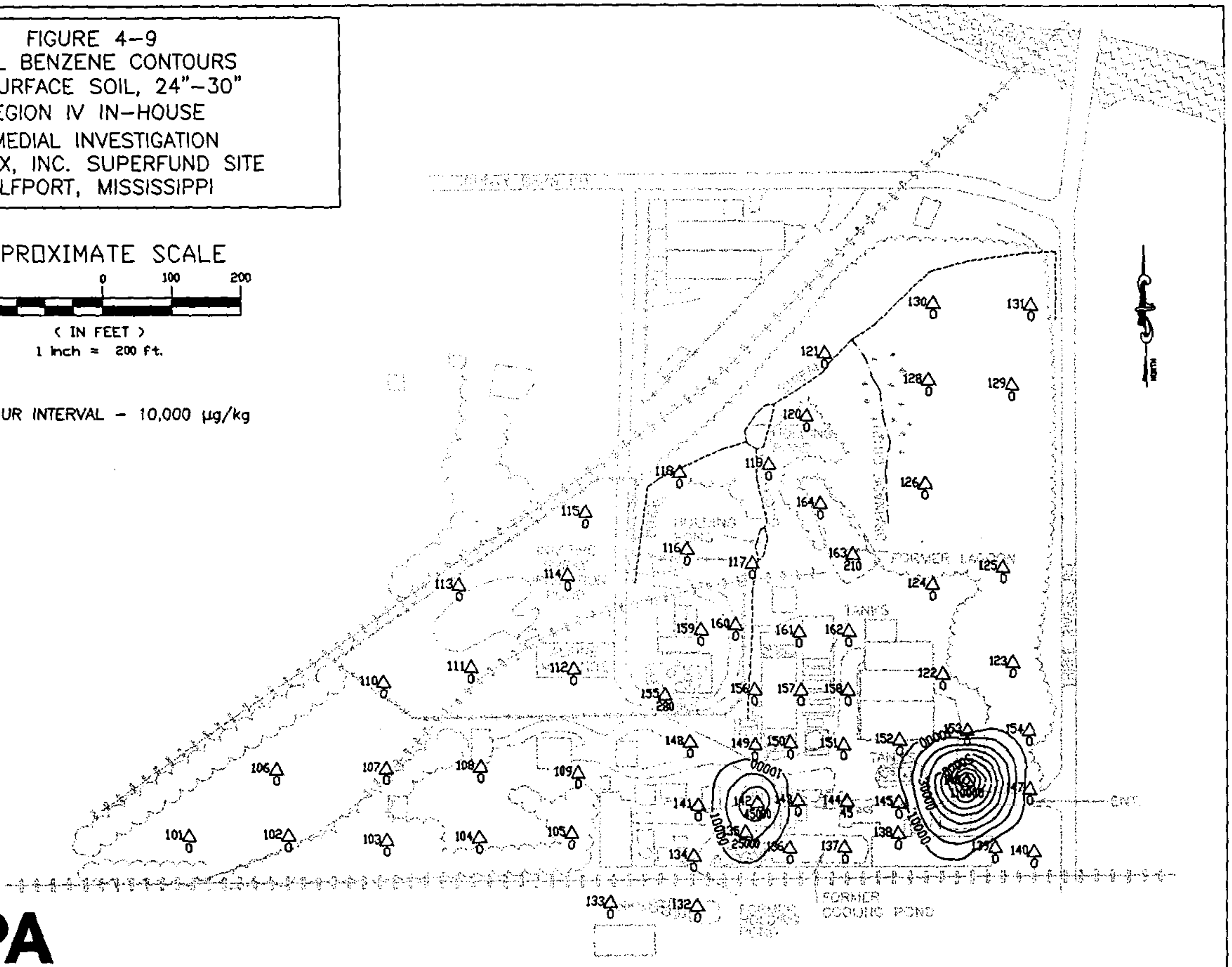
FIGURE 4-9
ETHYL BENZENE CONTOURS
SUBSURFACE SOIL, 24"–30"
REGION IV IN-HOUSE
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI

APPROXIMATE SCALE

200 0 100 200

(IN FEET)
1 inch = 200 ft.

CONTOUR INTERVAL – 10,000 µg/kg



EPA

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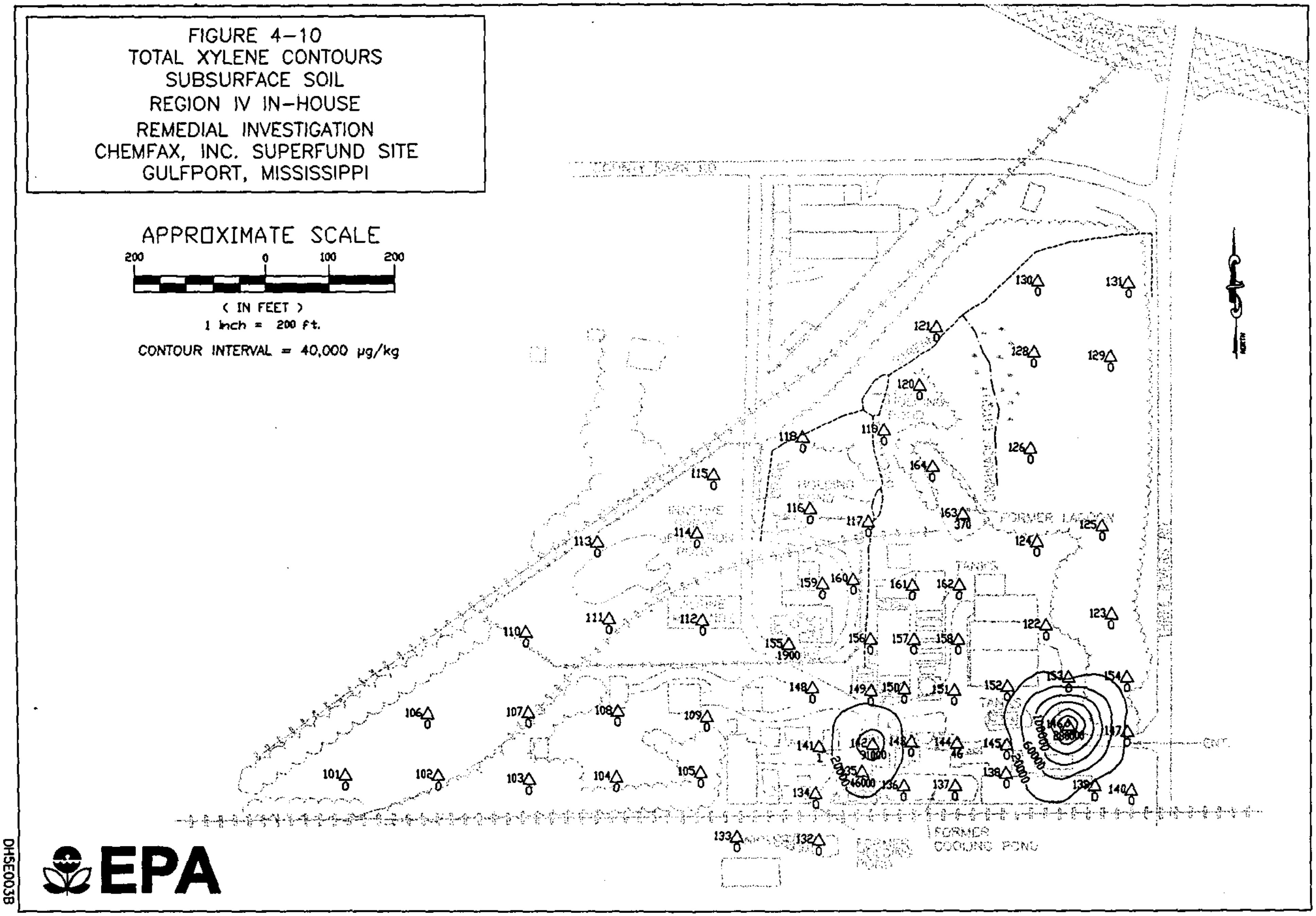


FIGURE 4-10
TOTAL XYLENE CONTOURS
SUBSURFACE SOIL
REGION IV IN-HOUSE
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI
APPROXIMATE SCALE
200 0 100 200
(IN FEET)
1 inch = 200 ft.
CONTOUR INTERVAL = 40,000 μg/kg
130 0
131 0
121 0
128 0
129 0
120 0
118 0
119 0
126 0
164 0
115 0
116 0
117 0
163 370
FORMER LAGOON
125 0
124 0
113 0
114 0
TANKS
159 0
160 0
161 0
162 0
123 0
111 0
110 0
112 0
122 0
155 1900
156 0
157 0
158 0
148 0
149 0
150 0
151 0
152 0
153 0
154 0
106 0
107 0
108 0
109 0
141 1
142 91000
143 0
144 46
145 0
146 268000
147 0
20000
60000
101 0
102 0
103 0
104 0
105 0
135 46000
136 0
137 0
138 0
139 0
140 0
134 0
133 0
132 0
FORMER COOLING POND
EPA
DH5E003B

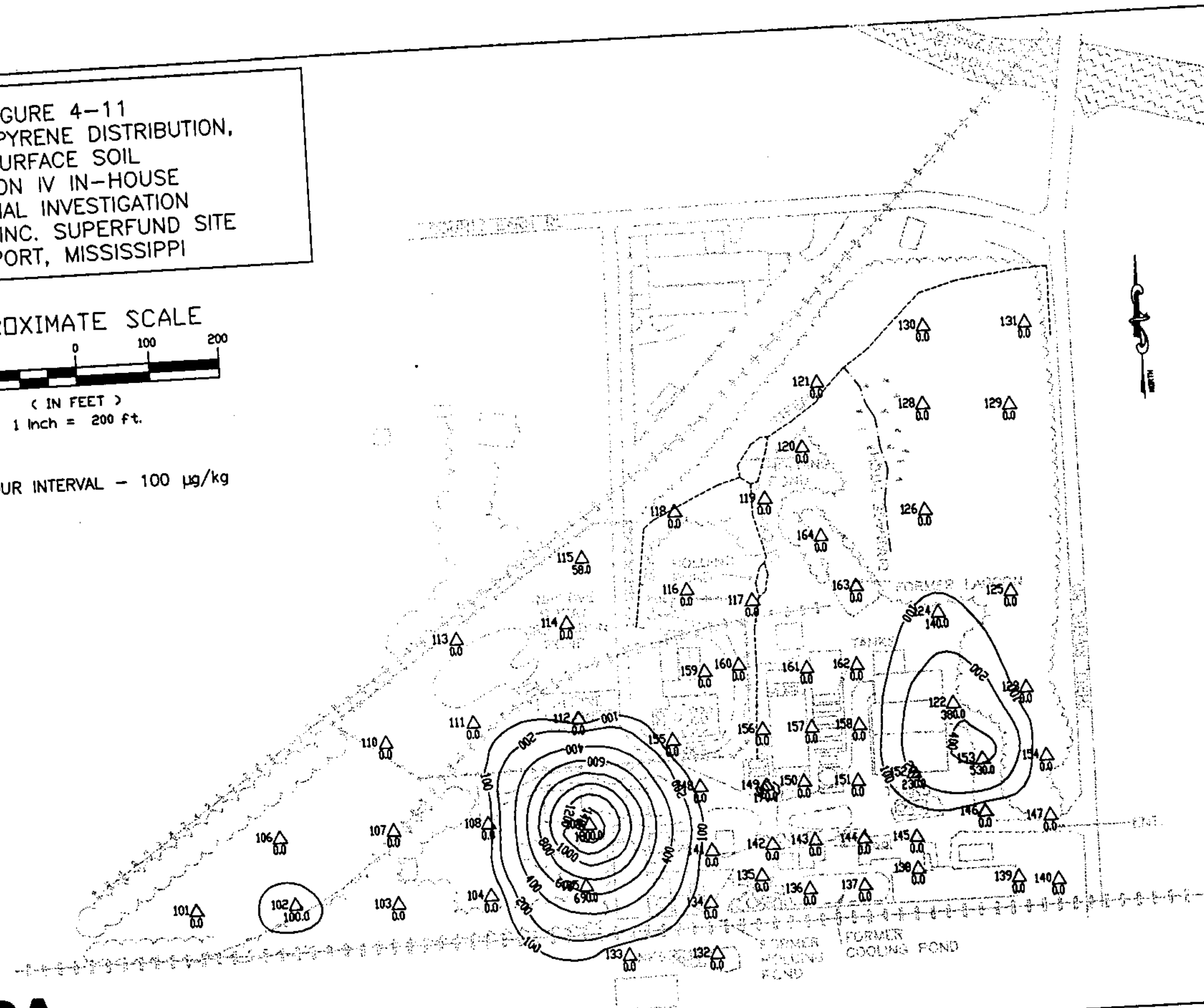
FIGURE 4-11
BENZO-A-PYRENE DISTRIBUTION,
SURFACE SOIL
REGION IV IN-HOUSE
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI

APPROXIMATE SCALE

200 0 100 200

(IN FEET)
1 Inch = 200 ft.

CONTOUR INTERVAL – 100 µg/kg



DH5E003B

EPA

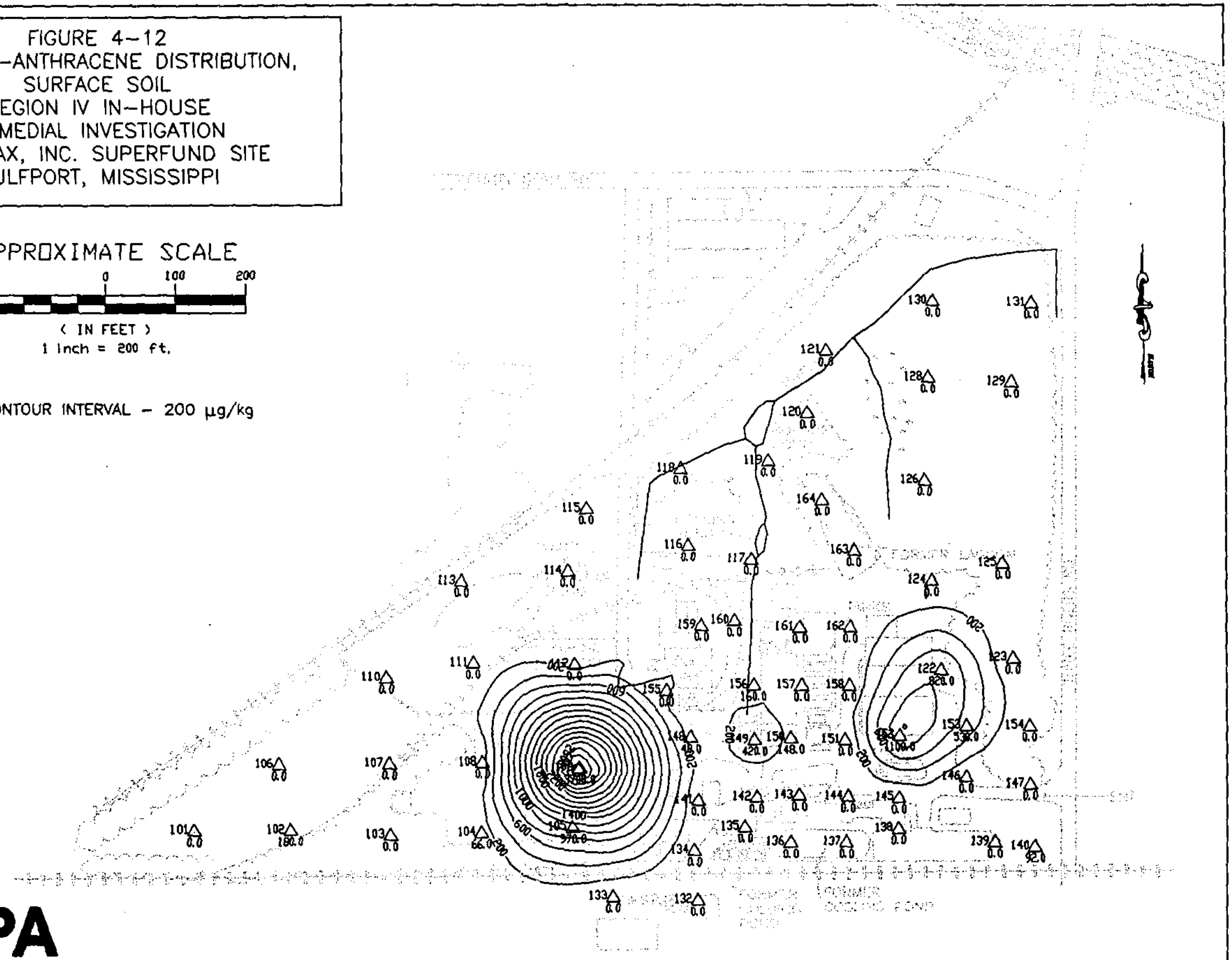
FIGURE 4–12
BENZO–A–ANTHRACENE DISTRIBUTION,
SURFACE SOIL
REGION IV IN–HOUSE
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI

APPROXIMATE SCALE

200 0 100 200

(IN FEET)
1 inch = 200 ft.

CONTOUR INTERVAL – 200 µg/kg



DH5E003

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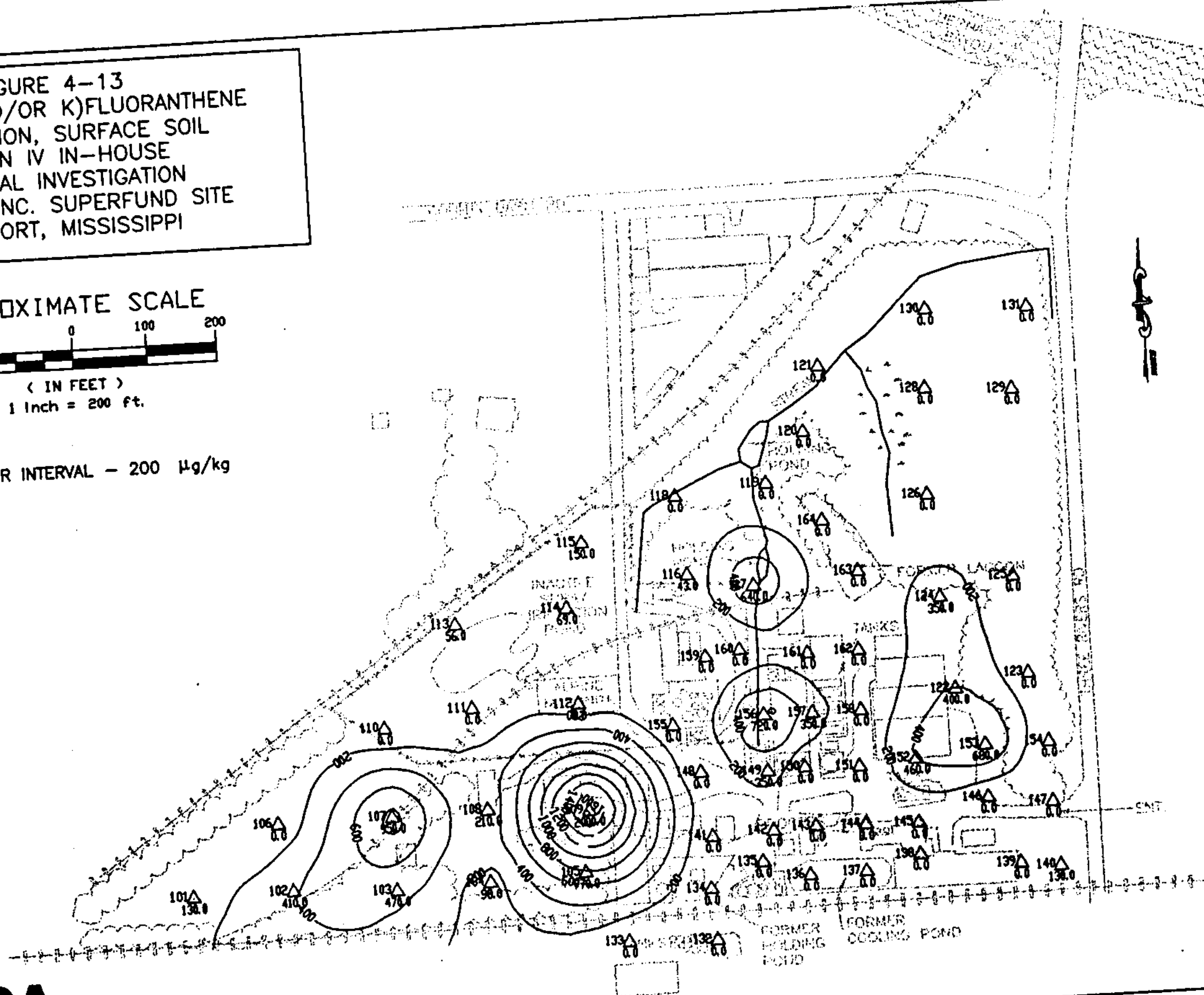
FIGURE 4-13
BENZO(B AND/OR K)FLUORANTHENE
DISTRIBUTION, SURFACE SOIL
REGION IV IN-HOUSE
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI

APPROXIMATE SCALE

200 0 100 200

(IN FEET)
1 Inch = 200 ft.

CONTOUR INTERVAL - 200 µg/kg



EPA

DH5E003

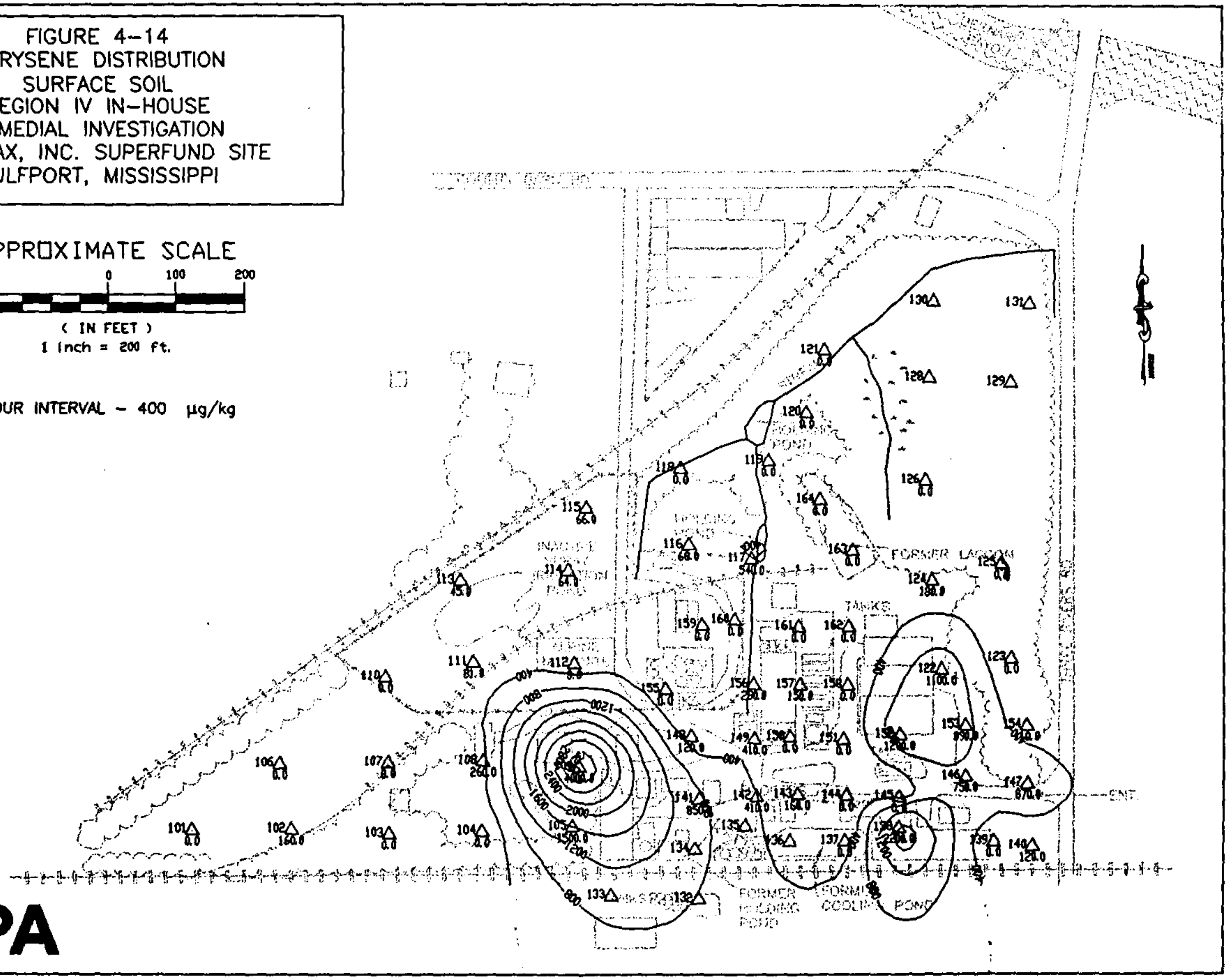
FIGURE 4-14
CHRYSENE DISTRIBUTION
SURFACE SOIL
REGION IV IN-HOUSE
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI

APPROXIMATE SCALE

200 0 100 200

(IN FEET)
1 inch = 200 ft.

CONTOUR INTERVAL – 400 µg/kg



EPA

DH5E003

FIGURE 4–15
BENZO-A-PYRENE DISTRIBUTION
SUBSURFACE SOIL, 24"–30"
REGION IV IN-HOUSE
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI

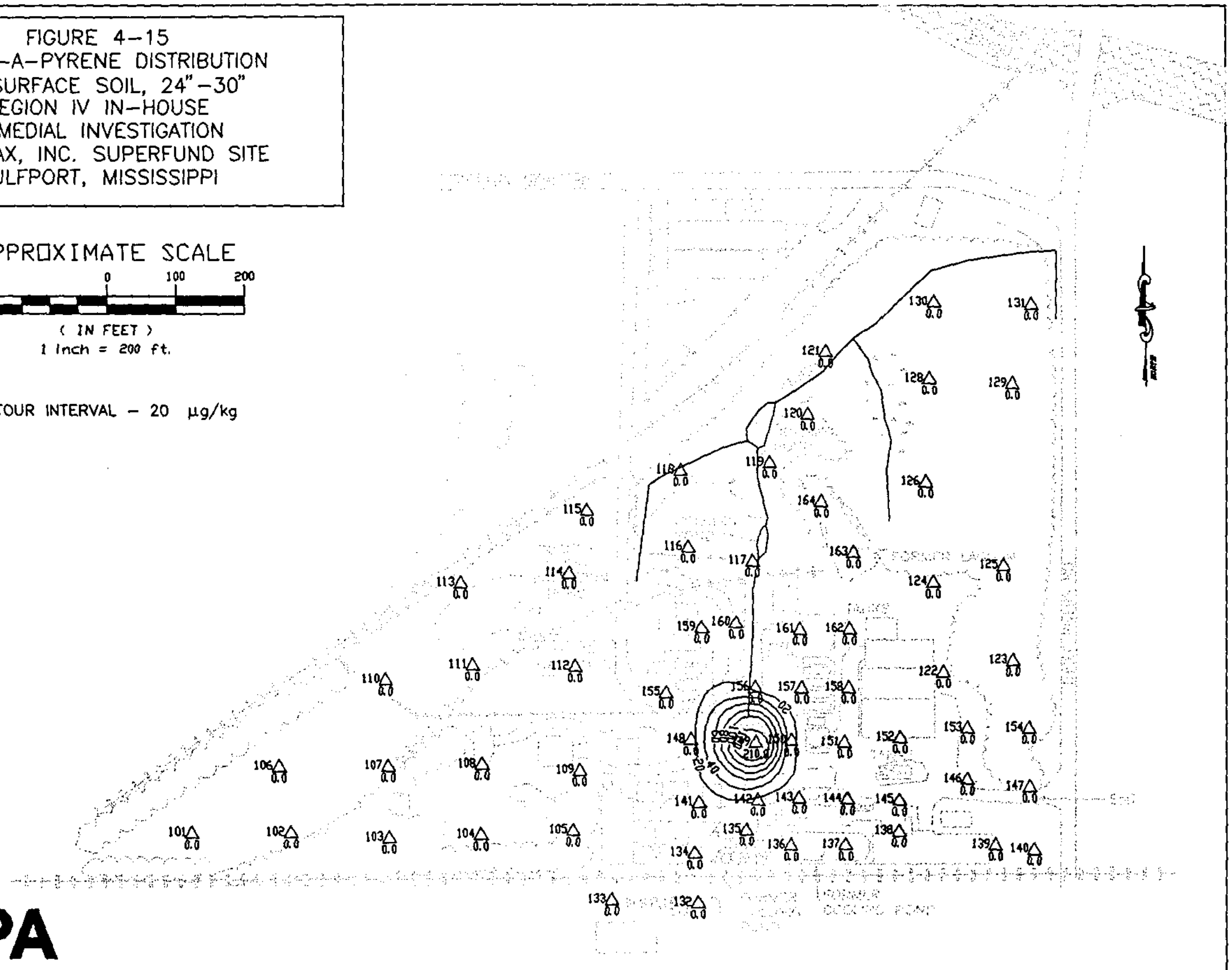
APPROXIMATE SCALE

200 0 100 200

(IN FEET)

1 inch = 200 ft.

CONTOUR INTERVAL – 20 µg/kg



EPA

DH5E003

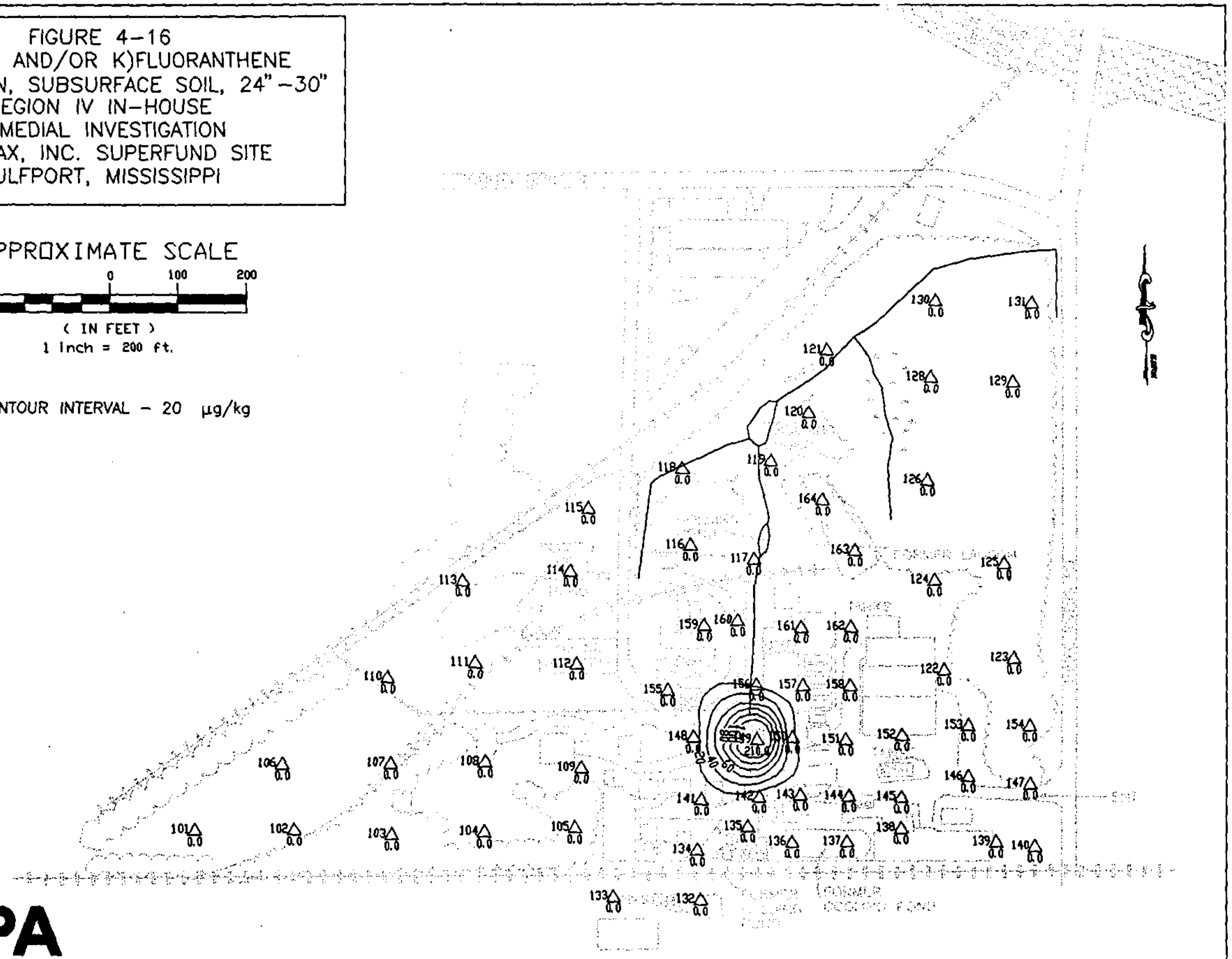
FIGURE 4-16
BENZO(B AND/OR K)FLUORANTHENE
DISTRIBUTION, SUBSURFACE SOIL, 24"-30"
REGION IV IN-HOUSE
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI

APPROXIMATE SCALE

200 0 100 200

(IN FEET)
1 Inch = 200 ft.

CONTOUR INTERVAL - 20 µg/kg



EPA

DH5E003

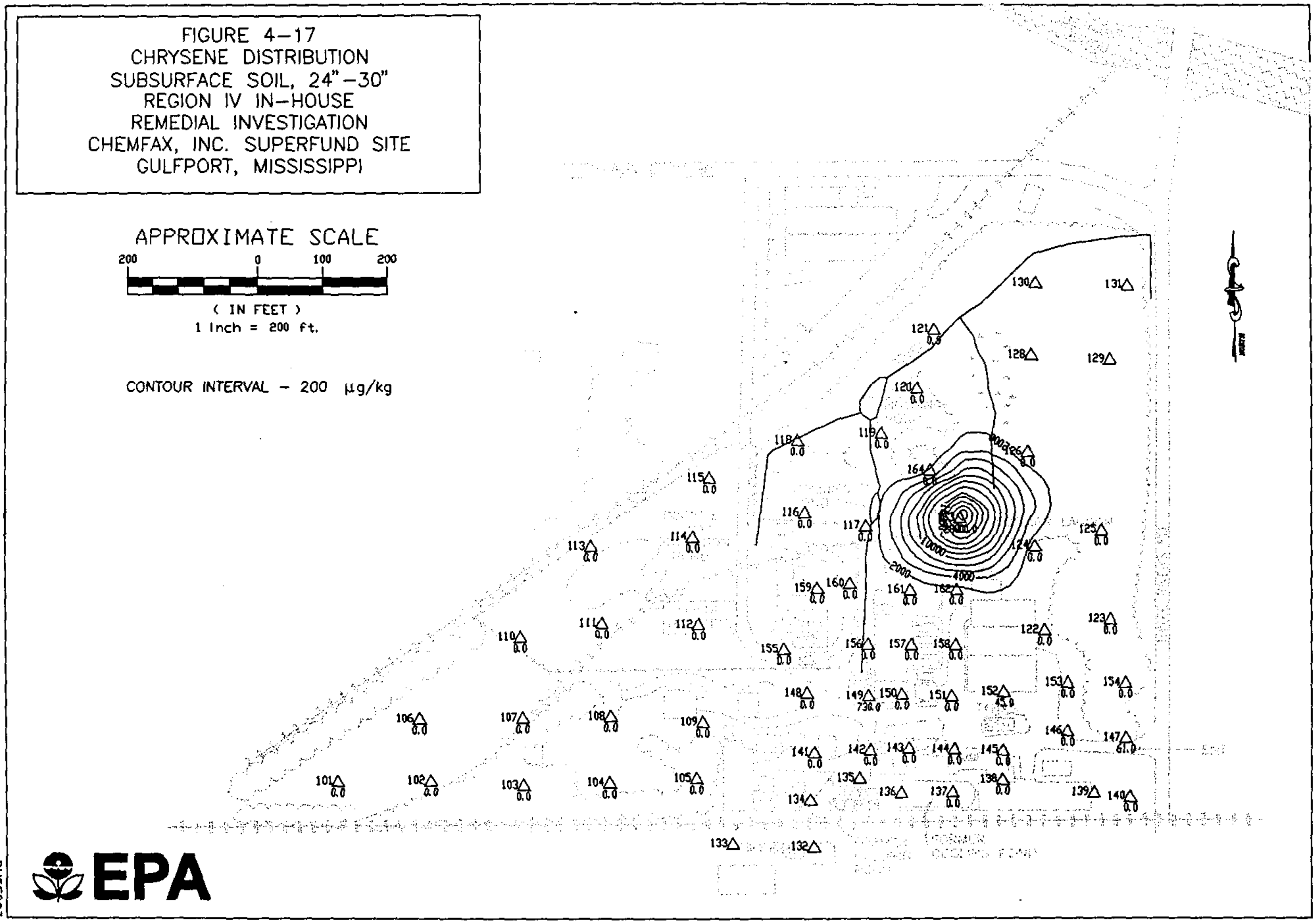


FIGURE 4-17
CHRYSENE DISTRIBUTION
SUBSURFACE SOIL, 24"-30"
REGION IV IN-HOUSE
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI
APPROXIMATE SCALE
200 0 100 200
(IN FEET)
1 Inch = 200 ft.
CONTOUR INTERVAL - 200 µg/kg
130
131
121
0.0
128
129
120
0.0
118
0.0
119
0.0
126
0.0
164
115
0.0
116
0.0
117
0.0
125
0.0
124
0.0
113
0.0
114
0.0
10000
2000
4000
159
0.0
160
0.0
161
0.0
162
0.0
123
0.0
111
0.0
112
0.0
122
0.0
110
0.0
155
0.0
156
0.0
157
0.0
158
0.0
153
0.0
154
0.0
148
0.0
149
730.0
150
0.0
151
0.0
152
45.0
106
0.0
107
0.0
108
0.0
109
0.0
146
0.0
147
61.0
141
0.0
142
0.0
143
0.0
144
0.0
145
0.0
101
0.0
102
0.0
103
0.0
104
0.0
105
0.0
135
138
0.0
134
136
137
0.0
139
140
0.0
133
132
EPA

DH5E003

FIGURE 4-18
BAPE VALUE CONTOUR
SURFACE SOIL
REGION IV IN-HOUSE
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI

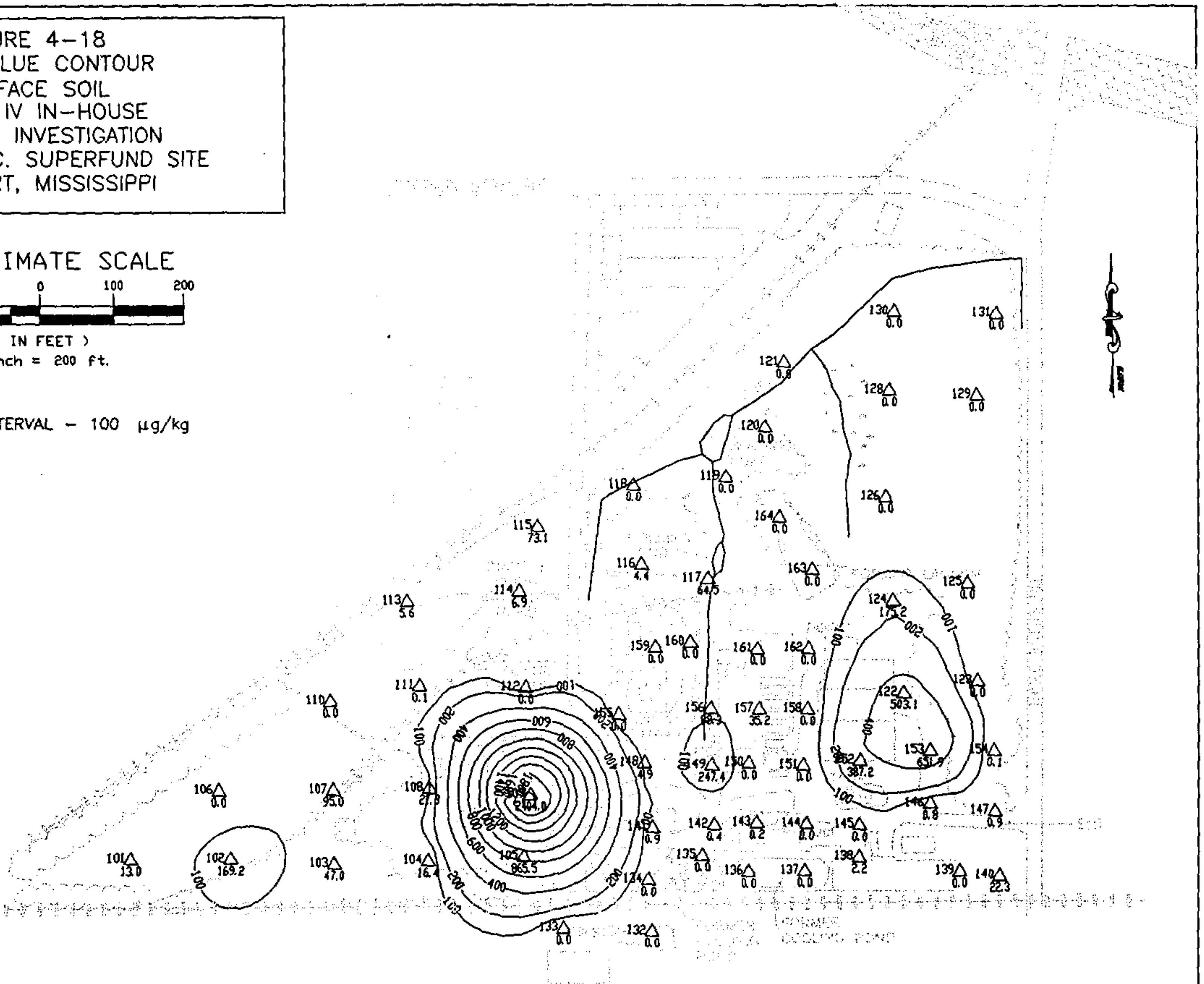
APPROXIMATE SCALE

200 0 100 200

(IN FEET)

1 inch = 200 ft.

CONTOUR INTERVAL – 100 $\mu g/kg$



EPA

DH5E003

FIGURE 4-19
BAPE VALUE CONTOUR
SUBSURFACE SOIL, 24"-30"
REGION IV IN-HOUSE
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI

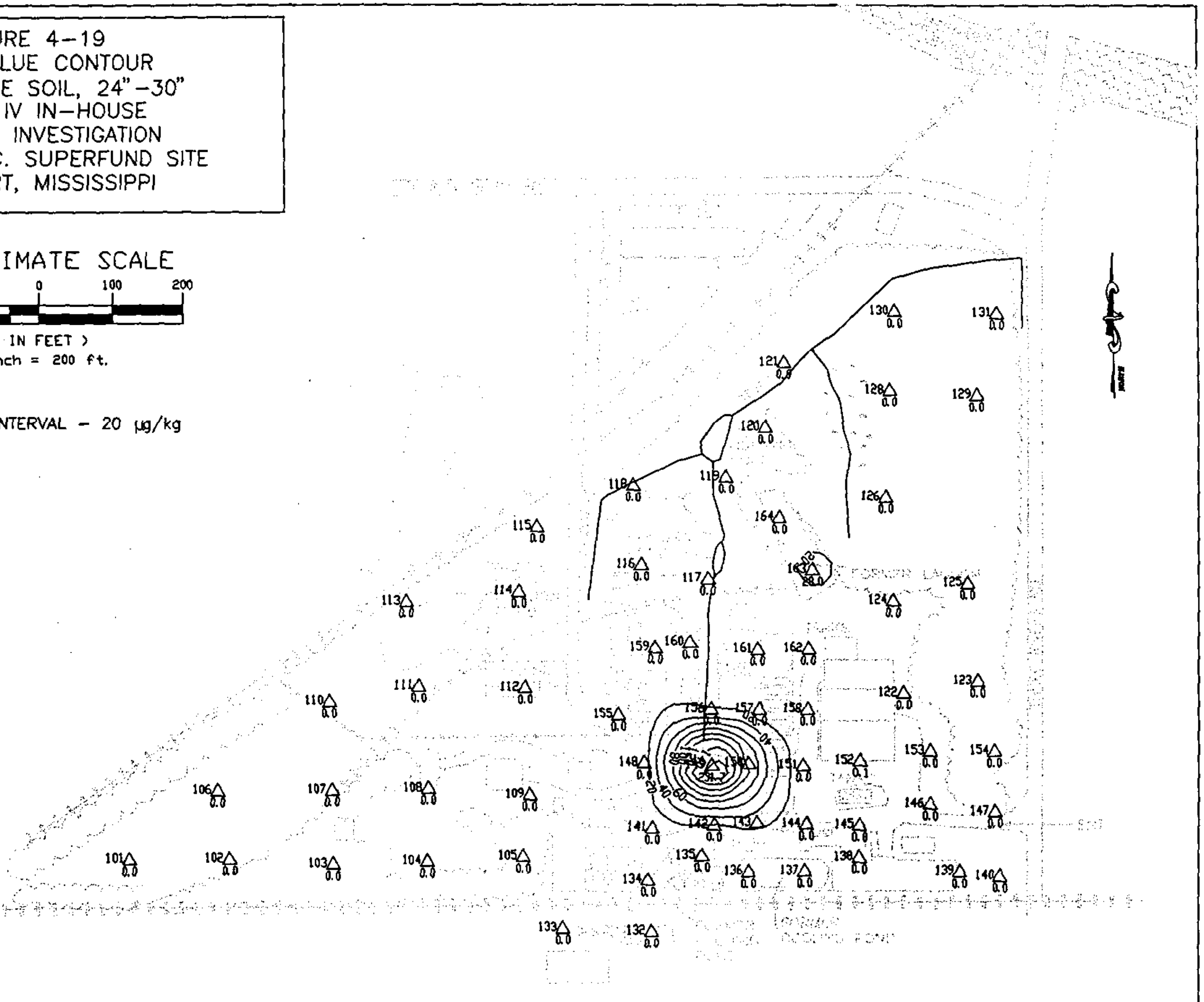
APPROXIMATE SCALE

200 0 100 200

(IN FEET)

1 Inch = 200 ft.

CONTOUR INTERVAL - 20 µg/kg



EPA

DH5E003

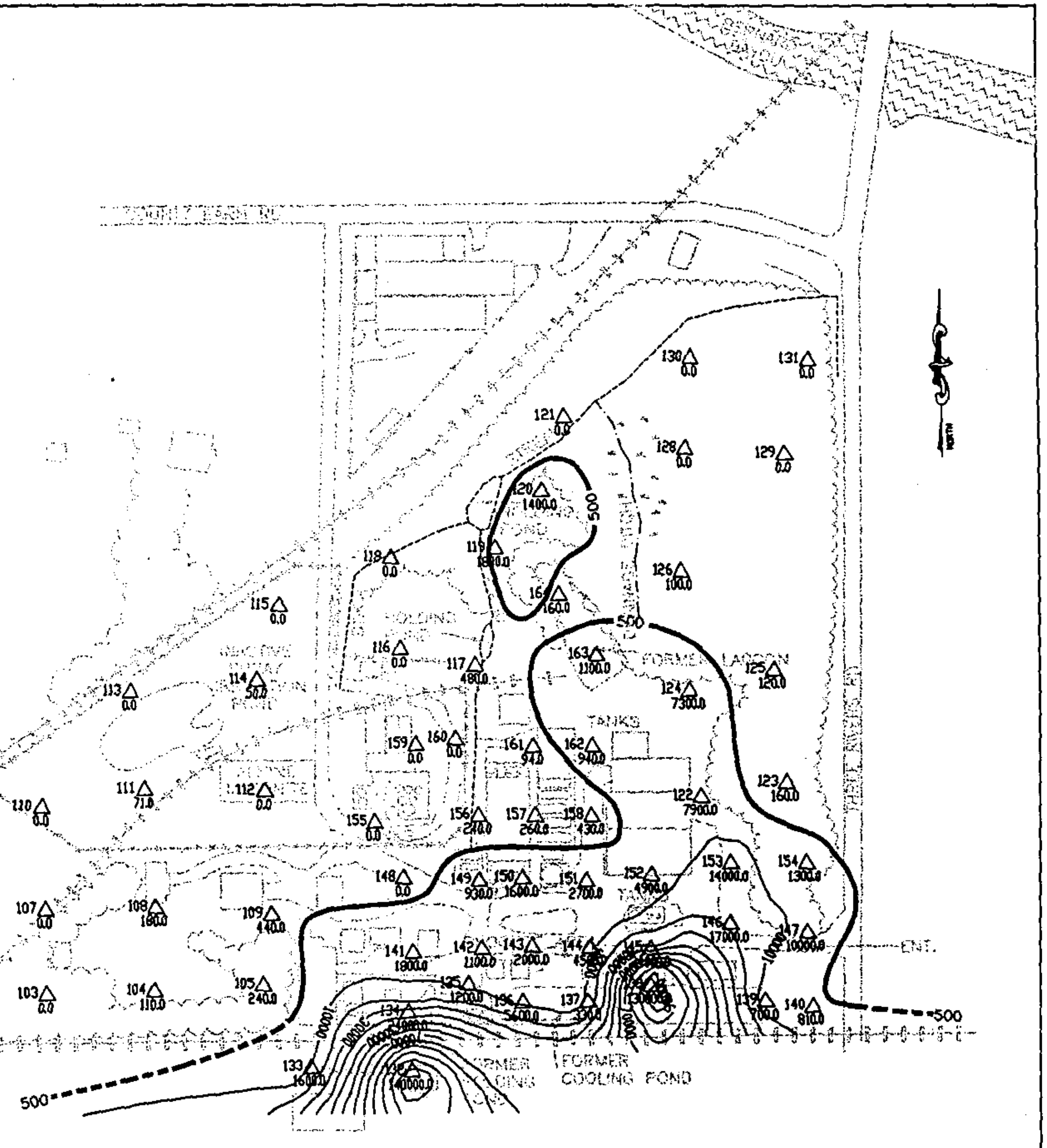
FIGURE 4-20
NAPHTHALENE CONCENTRATION CONTOUR
SURFACE SOIL
REGION IV IN-HOUSE
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI

APPROXIMATE SCALE

200 0 100 200

(IN FEET)
1 inch = 200 ft.

CONTOUR INTERVAL - 10,000 µg/kg
WITH 500 µg/kg BOUNDARY



EPA

DH5E003B

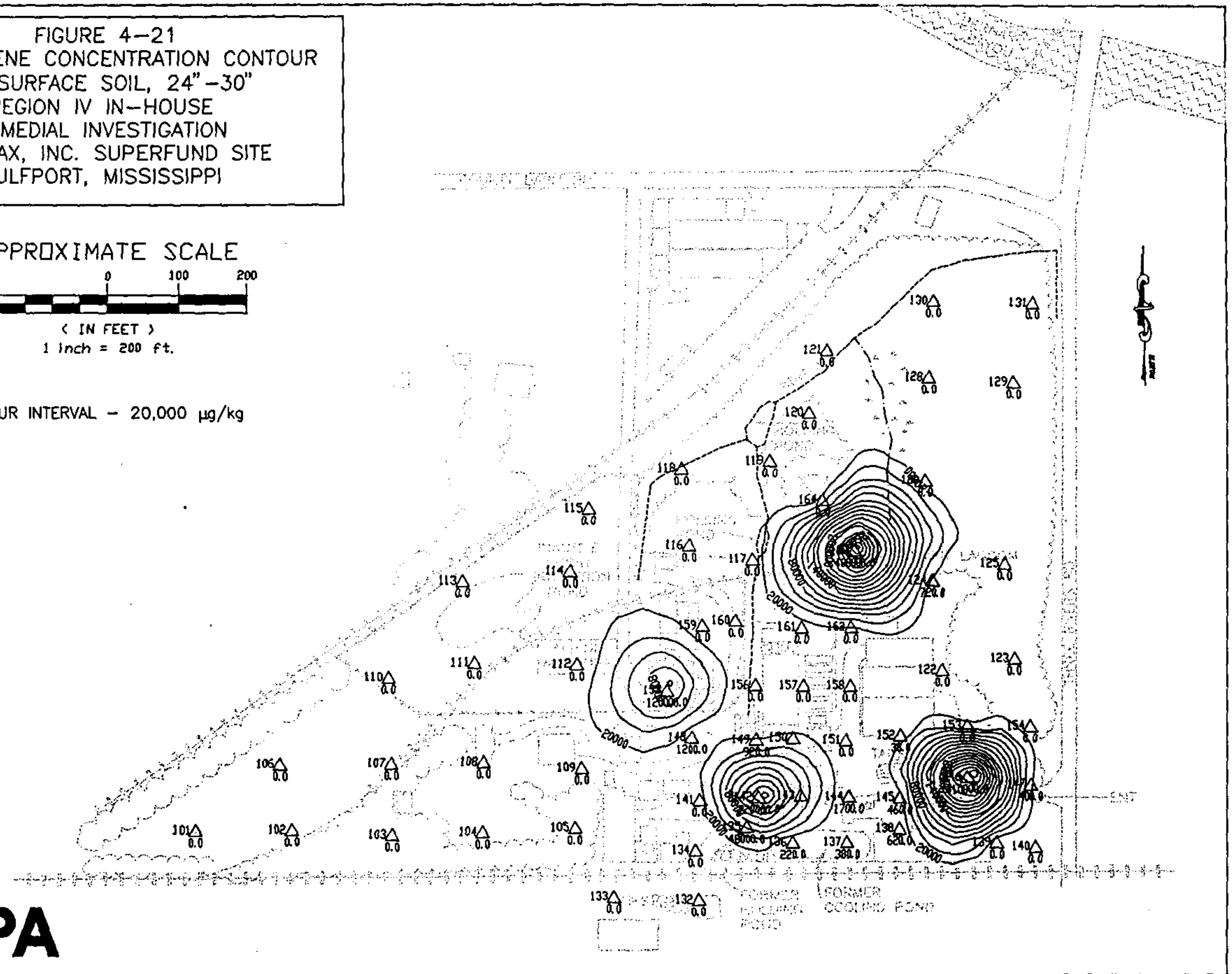
FIGURE 4–21
NAPHTHALENE CONCENTRATION CONTOUR
SUBSURFACE SOIL, 24"–30"
REGION IV IN–HOUSE
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI

APPROXIMATE SCALE

200 0 100 200

(IN FEET)
1 inch = 200 ft.

CONTOUR INTERVAL – 20,000 μg/kg



EPA

DH5E003

FIGURE 4-22
PHENANTHRENE CONCENTRATION CONTOUR
SURFACE SOIL
REGION IV IN-HOUSE
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI

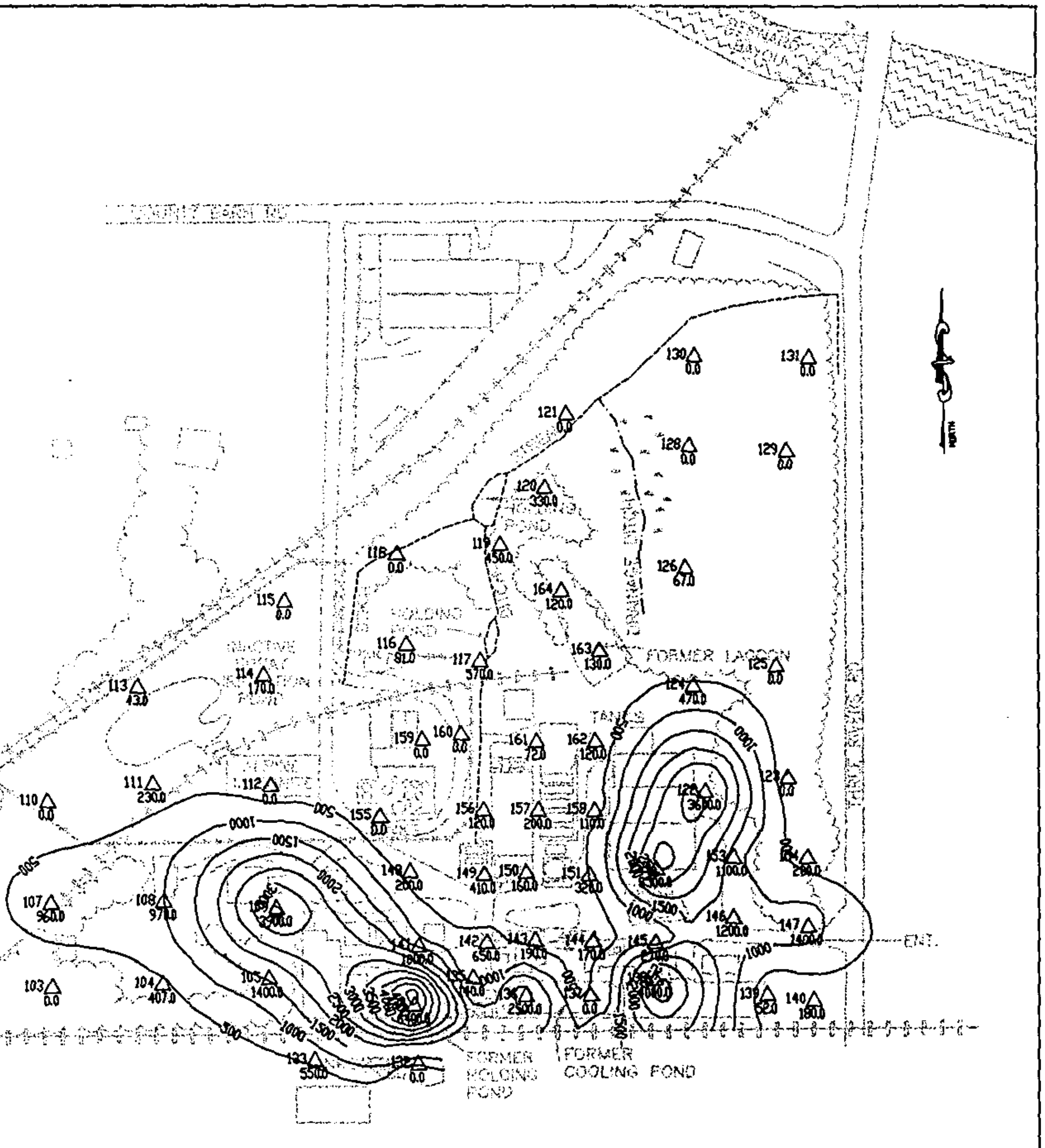
APPROXIMATE SCALE

200 0 100 200

(IN FEET)

1 Inch = 200 ft.

CONTOUR INTERVAL - 500 µg/kg



EPA

DH5E003B

FIGURE 4-23
PHENANTHRENE CONCENTRATION CONTOUR
SUBSURFACE SOIL, 24"-30"
REGION IV IN-HOUSE
REMEDIAL INVESTIGATION
CHEMFAX, INC. SUPERFUND SITE
GULFPORT, MISSISSIPPI

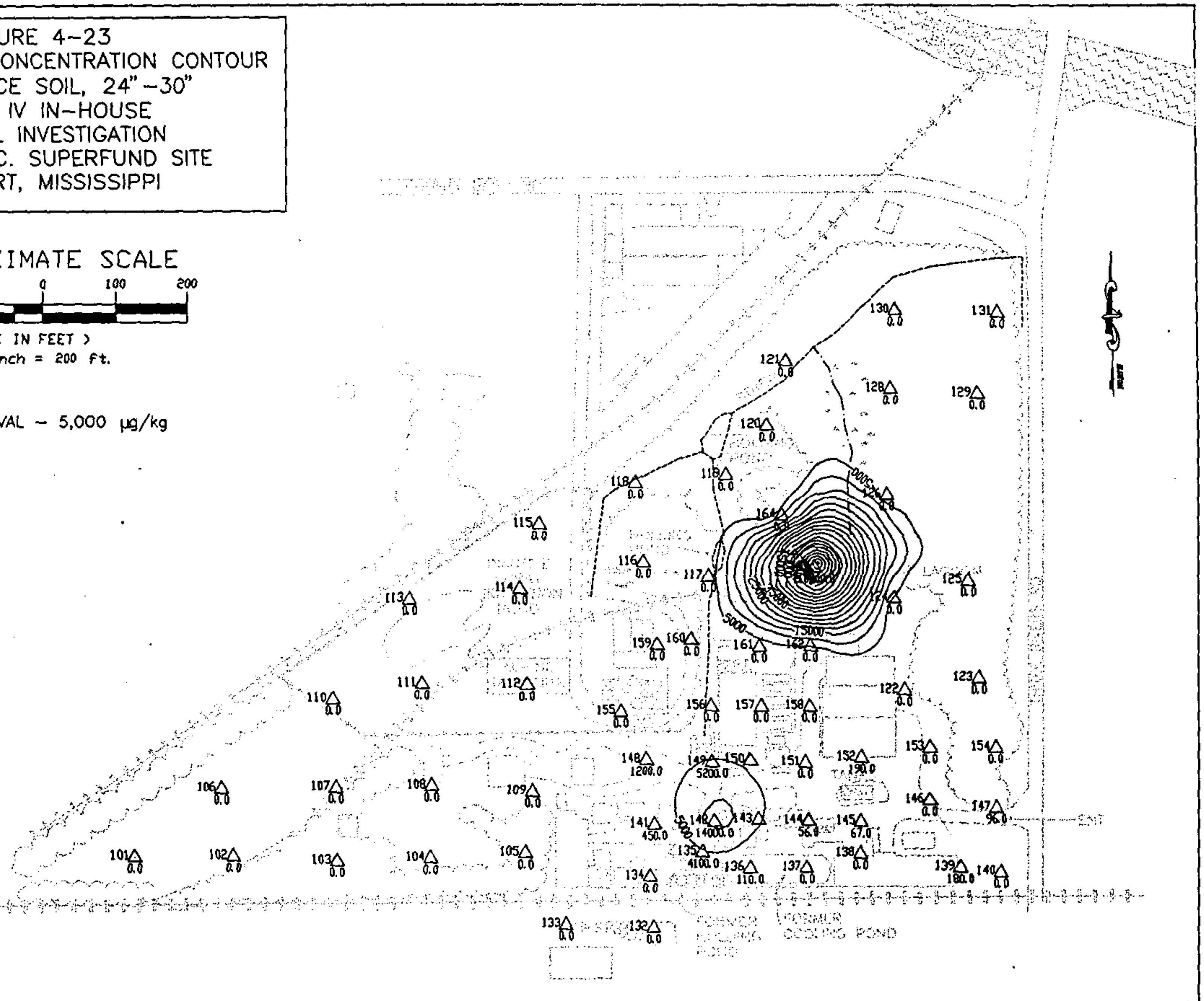
APPROXIMATE SCALE

200 0 100 200

(IN FEET)

1 inch = 200 ft.

CONTOUR INTERVAL - 5,000 μg/kg



EPA

DHSE003

FIGURE 4-24
GROUND WATER SAMPLING LOCATIONS
REMEDIAL INVESTIGATION
CHEMFAX, INC, SUPERFUND SITE
GULFPORT, MISSISSIPPI

APPROXIMATE SCALE

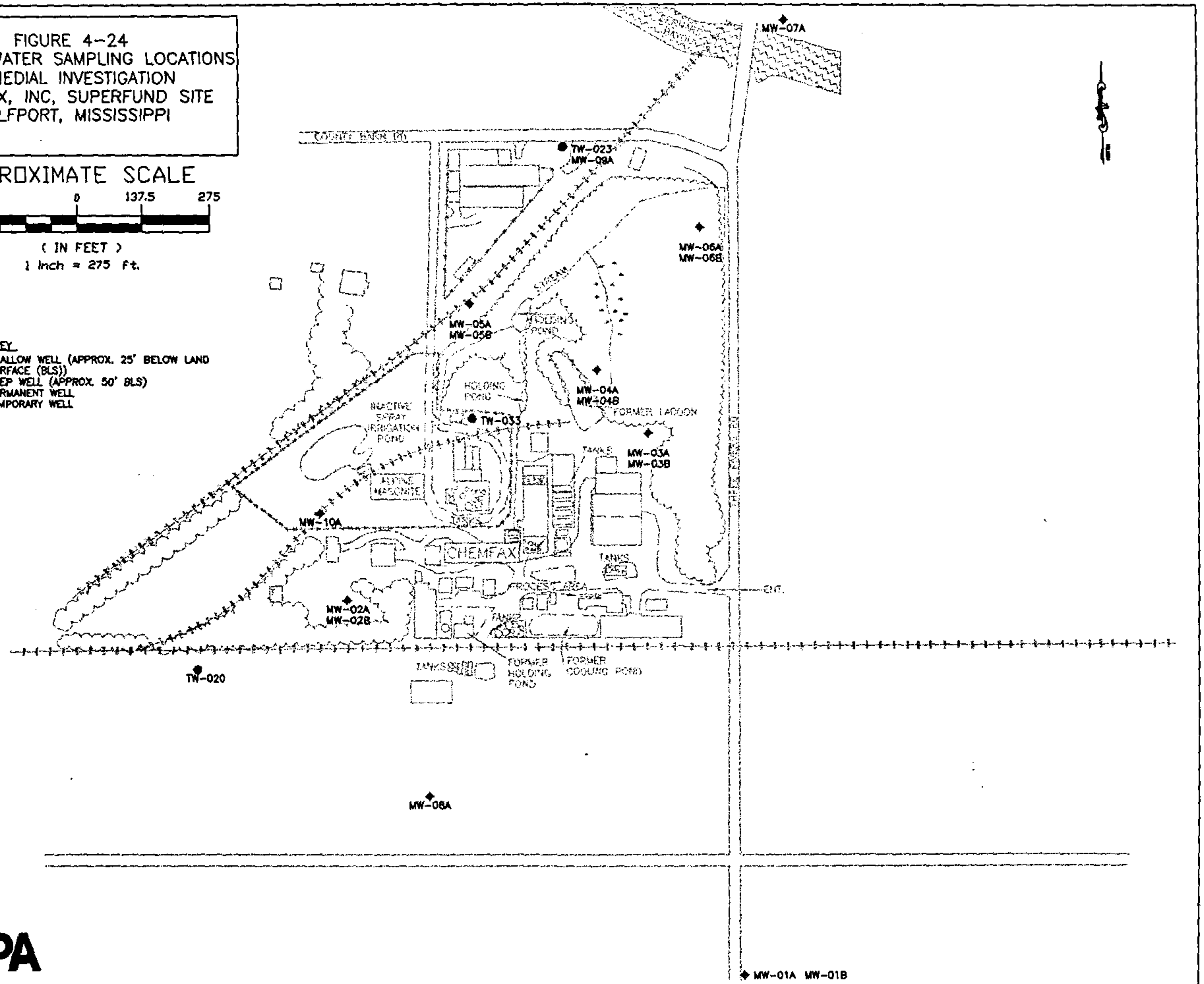
275 0 137.5 275

(IN FEET)

1 inch = 275 ft.

KEY

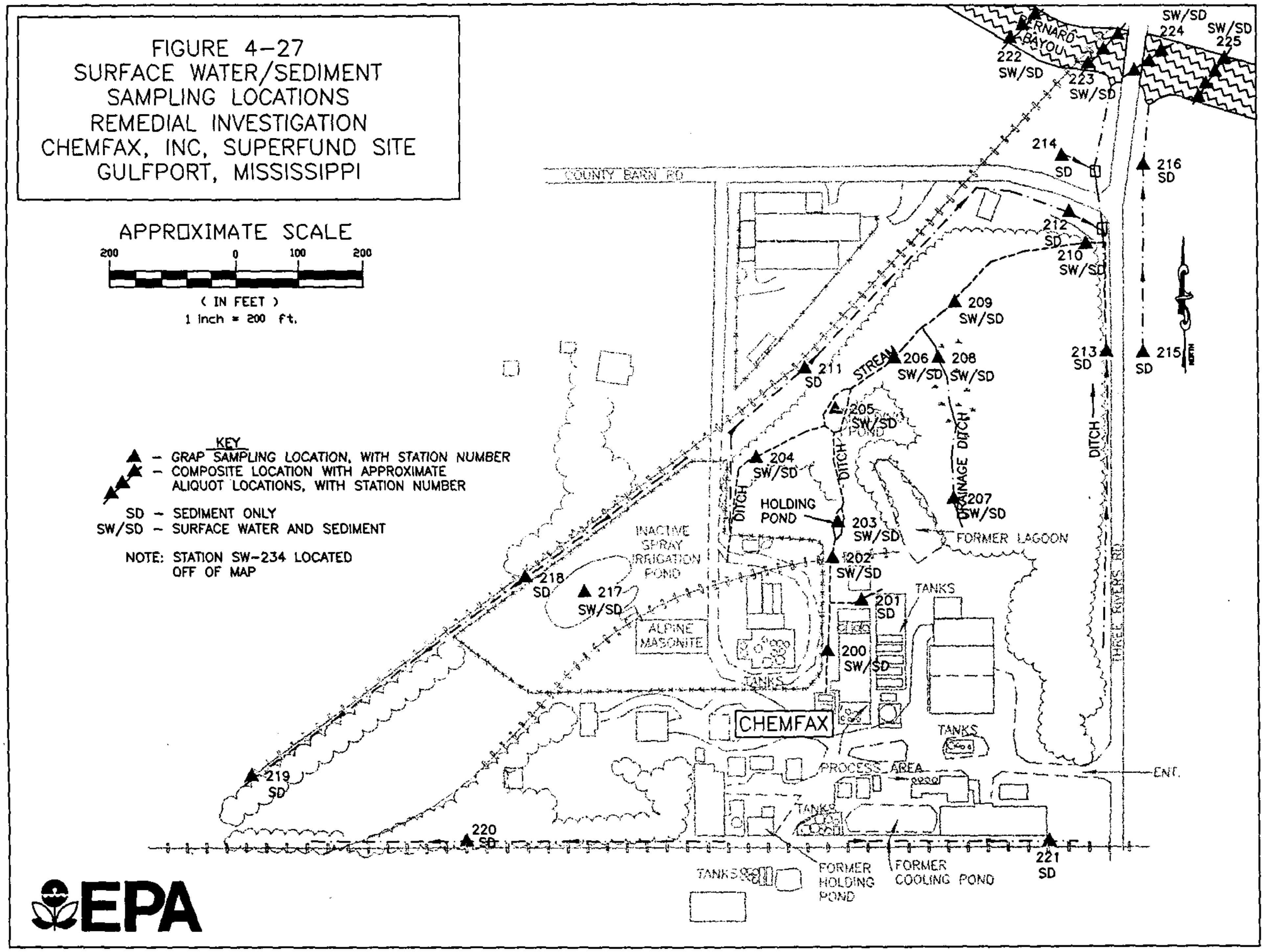
A – SHALLOW WELL (APPROX. 25' BELOW LAND SURFACE (BLS))
B – DEEP WELL (APPROX. 50' BLS)
MW – PERMANENT WELL
TW – TEMPORARY WELL



EPA

DHSE003C/0795

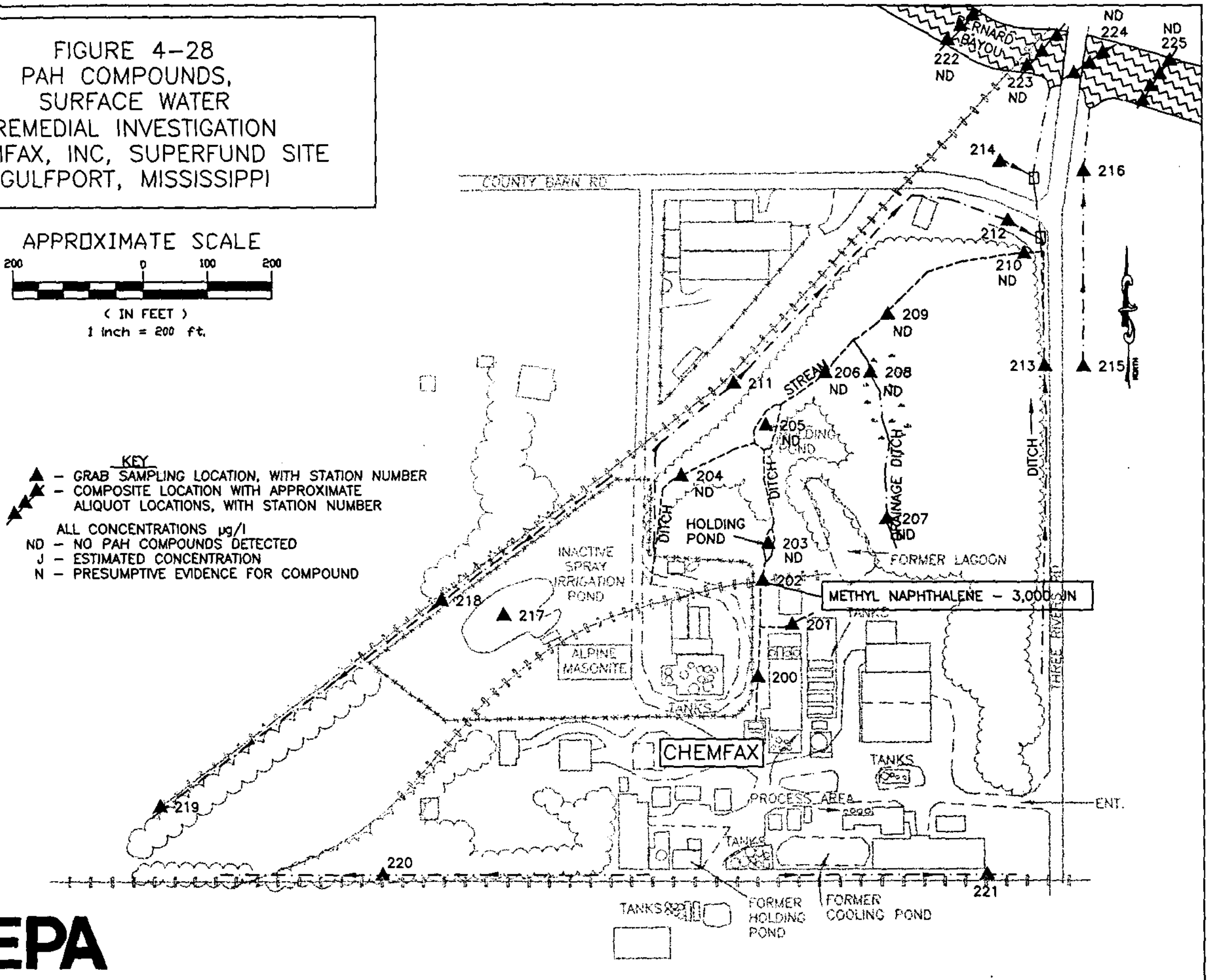
FIGURE 4-27
SURFACE WATER/SEDIMENT SAMPLING LOCATIONS
REMEDIAL INVESTIGATION
CHEMFAX, INC, SUPERFUND SITE
GULFPORT, MISSISSIPPI



EPA

DH5E003

FIGURE 4-28
PAH COMPOUNDS,
SURFACE WATER
REMEDIAL INVESTIGATION
CHEMFAX, INC, SUPERFUND SITE
GULFPORT, MISSISSIPPI



EPA

DH5E003

FIGURE 4-29
BTEX CONCENTRATIONS
SEDIMENT
REMEDIAL INVESTIGATION
CHEMFAX, INC, SUPERFUND SITE
GULFPORT, MISSISSIPPI

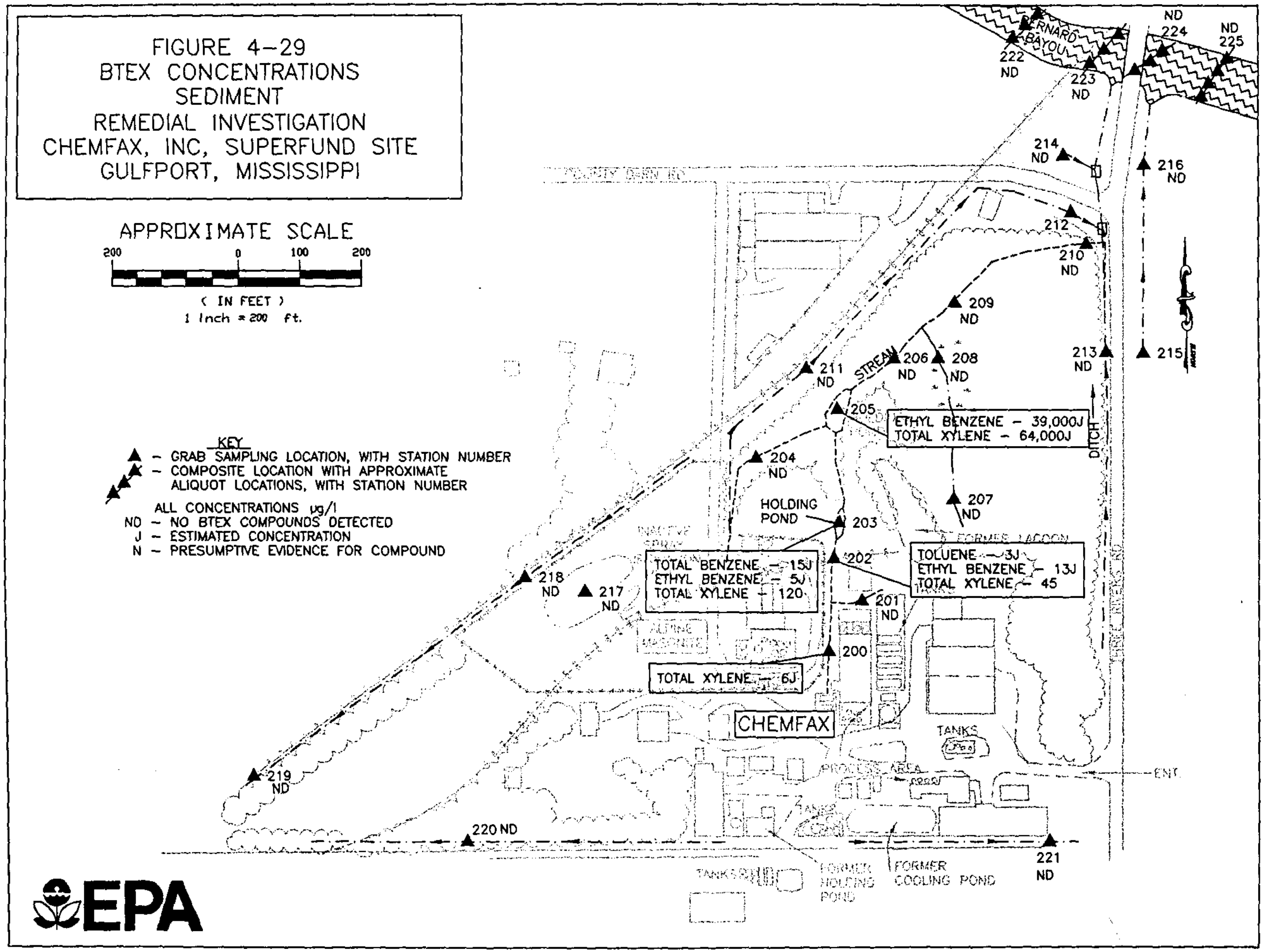


FIGURE 4-30
BAPE LEVELS
SEDIMENT
REMEDIAL INVESTIGATION
CHEMFAX, INC, SUPERFUND SITE
GULFPORT, MISSISSIPPI

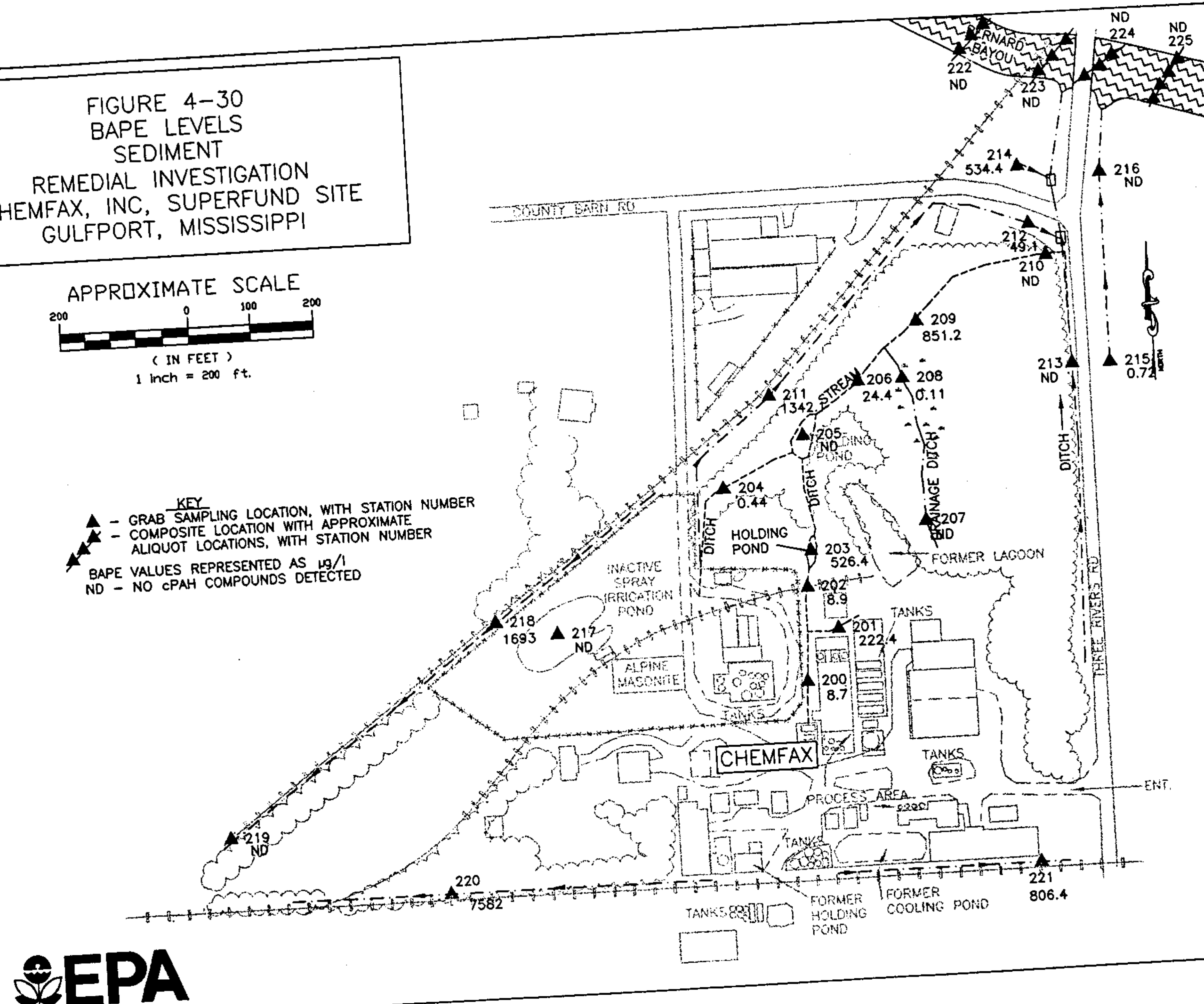


TABLE 4-19
ANALYTICAL DATA SUMMARY, SURFACE WATER
ON-SITE DRAINAGE
CHEMFAX, INC SUPERFUND SITE
GULFPORT, MISSISSIPPI

	CI-200 DITCH PRO AREA 01/19/95 1330	CI-202 DITCH PRO AREA 01/18/95 1445	CI-203 UPPER HLD POND 01/19/95 1045	CI-204 WEST TRIB 01/18/95 1400	CI-205 LOWER HLD POND 01/19/95 0840	CI-206 N OF LWR HLD POND 01/18/95 1255	CI-207 E. TRIB, UPPER 01/19/95 0905	CI-208 E. TRIB, LOWER 01/19/95 1350	CI-209 LOWER STREAM 01/19/95 1050	CI-232 DUPE OF CI-209 01/19/95 1055	CI-210 LOWER STREAM 01/18/95 1115
INORGANIC ELEMENTS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
ARSENIC	--	--	--	--	--	--	--	20	--	--	--
BARIUM	--	--	--	24	--	--	27	--	--	--	--
COPPER	--	--	66	--	--	--	--	--	60	--	--
NICKEL	--	--	--	--	--	--	--	--	--	15J	--
LEAD	10	4	3	--	4	--	9	7J	6	4J	3J
VANADIUM	--	--	2J	--	2J	--	5J	--	3J	--	--
ZINC	310	83	120	37	78.0	65	44	49	50	45	33
MERCURY	0.20UR	0.20UR	0.20UR	0.20UR	0.20UR	0.20UR	0.20UR	0.20UR	0.20UR	0.20UR	0.20UR
ALUMINUM	--	--	840	--	660	--	2100	--	1200	--	--
MANGANESE	42	45	36	82	34	66	77	100	50	42	58
CALCIUM	13000	9700	13000	48000	11000	12000	7900	8600	10000	9400	11000
MAGNESIUM	--	270	--	1400	--	--	1200	1200	770	710	820
IRON	1600	1200	1700	1300	1500	1500	4600	2200	2200	1400	1200
SODIUM	22000	46000	19000	8900	27000	30000	16000	15000	23000	23000	25000
POTASSIUM	440	520	620	760	510	560	1000	1100	840	760	620
EXTRACTABLE ORGANIC COMPOUNDS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
METHYLNAPHTHALENE	--	3000JN	--	--	--	--	--	--	--	--	--
BENZYL ALCOHOL	--	--	5JN	--	--	--	--	--	--	--	--
BENZYLALCOHOL	--	--	--	--	6JN	--	--	--	--	--	--
DIHYDROINDENEDIOL	--	--	--	--	6JN	--	--	--	--	--	--
26 UNIDENTIFIED COMPOUNDS	--	100000J	--	--	--	--	--	--	--	--	--
14 UNIDENTIFIED COMPOUNDS	--	--	--	--	200J	300J	--	--	--	--	--
12 UNIDENTIFIED COMPOUNDS	--	--	--	--	--	--	--	--	--	--	200J
5 UNIDENTIFIED COMPOUNDS	--	--	--	90J	--	--	--	--	--	--	--
PURGEABLE ORGANIC COMPOUNDS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
1 UNIDENTIFIED COMPOUND	--	--	--	--	20J	--	--	--	--	--	--

*****FOOTNOTES***

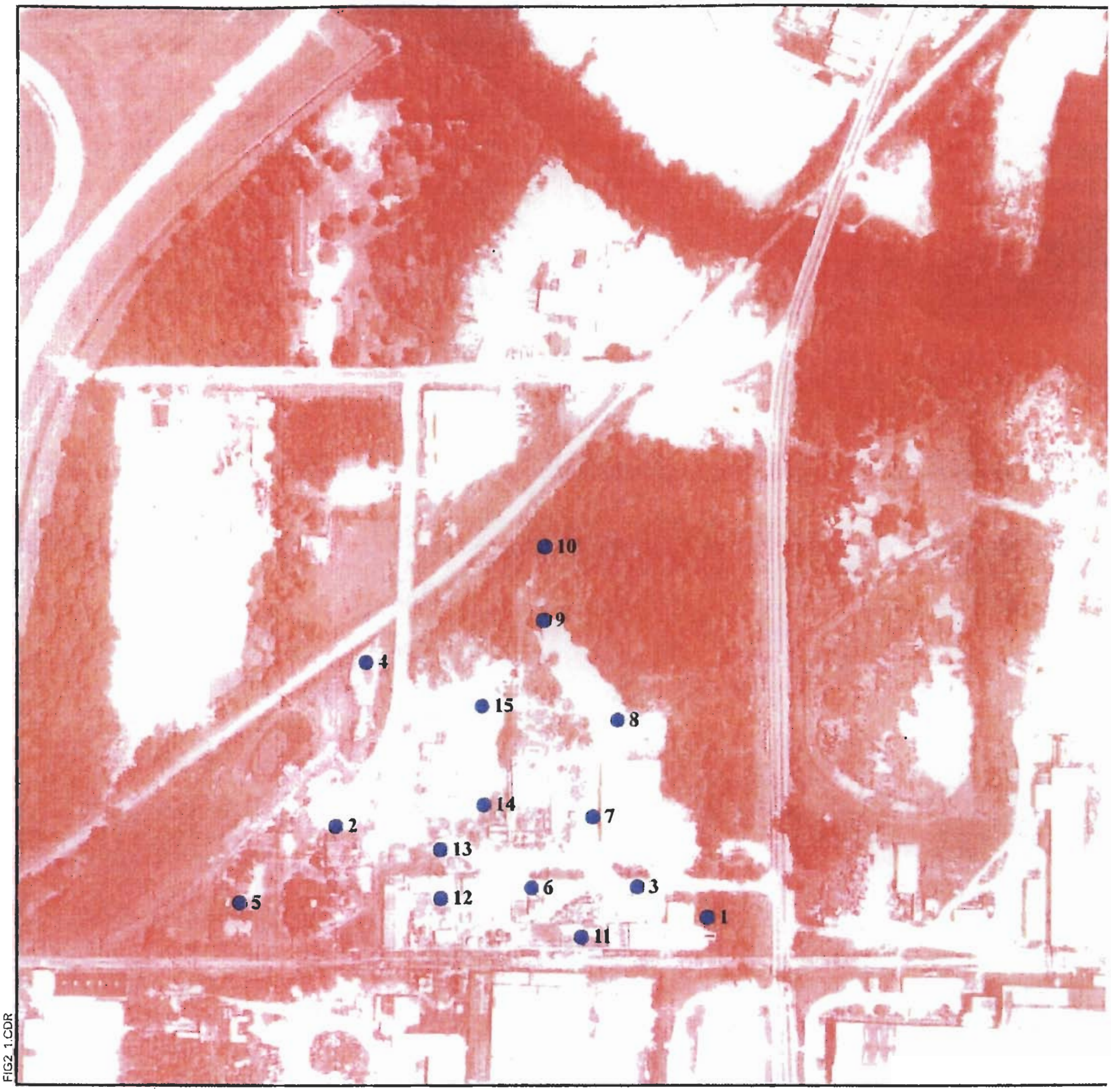
NA - NOT ANALYZED; J - ESTIMATED VALUE; N - PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
-- - MATERIAL WAS ANALYZED FOR BUT NOT DETECTED; U - MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT
R - QUALITY CONTROL INDICATES THAT DATA ARE UNUSABLE, COMPOUND MAY OR MAY NOT BE PRESENT
RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION, THE VALUE IS THAT REPORTED BY THE LABORATORY

TABLE 4-20
ANALYTICAL DATA SUMMARY, SURFACE WATER
SPRAY POND AND OFF-SITE SAMPLES
CHEMFAX, INC SUPERFUND SITE
GULFPORT, MISSISSIPPI

	CI-217 SPRAY IRR POND 01/18/95 1445	CI-222 BERNARD BAYOU 1 01/19/95 1530	CI-223 BERNARD BAYOU 2 01/18/95 1300	CI-224 BERNARD BAYOU 3 01/18/95 1150	CI-225 BERNARD BAYOU 4 01/19/95 1515	CI-234 REF STREAM 01/19/95 0900
INORGANIC ELEMENTS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
ARSENIC	--	--	--	10J	--	--
BARIUM	--	25	27	26	26	25
COPPER	29	--	33	--	--	--
NICKEL	--	--	--	--	11J	26J
LEAD	3	4	--	5	4	7
VANADIUM	--	5J	2J	--	4J	5J
ZINC	34	29	--	39	390	38
MERCURY	0.20UR	0.20UR	0.20UR	0.20UR	0.20UR	0.20UR
ALUMINUM	--	2900	1200	--	5800	2500
MANGANESE	16	33	37	36	39	31
CALCIUM	5700	2600	4600	5200	2900	12000
MAGNESIUM	760	820	3600	4900	930	1000
IRON	--	2000	1400	1100	2100	3000
SODIUM	6700	3400	23000	31000	3800	5000
POTASSIUM	1100	630	1400	1700	1900	2500
EXTRACTABLE ORGANIC COMPOUNDS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
PHYTOL	20JN	--	--	--	--	--
17 UNIDENTIFIED COMPOUNDS	6000J	--	--	--	--	--
PURGEABLE ORGANIC COMPOUNDS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
NO PURGEABLE ORGANIC COMPOUNDS DETECTED	--	--	--	--	--	--

****

FOOTNOTES
NA - NOT ANALYZED
J - ESTIMATED VALUE
N - PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
-- - MATERIAL WAS ANALYZED FOR BUT NOT DETECTED
U - MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT
R - QUALITY CONTROL INDICATES THAT DATA ARE UNUSABLE, COMPOUND MAY OR MAY NOT BE PRESENT
RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION, THE VALUE IS THAT REPORTED BY THE LABORATORY



Legend:

● GeoProbe Location

Figure 2-1

Geoprobe Sample Location Map
Supplemental Sampling Investigation
ChemFax, Inc.
Gulfport, Mississippi

EPA

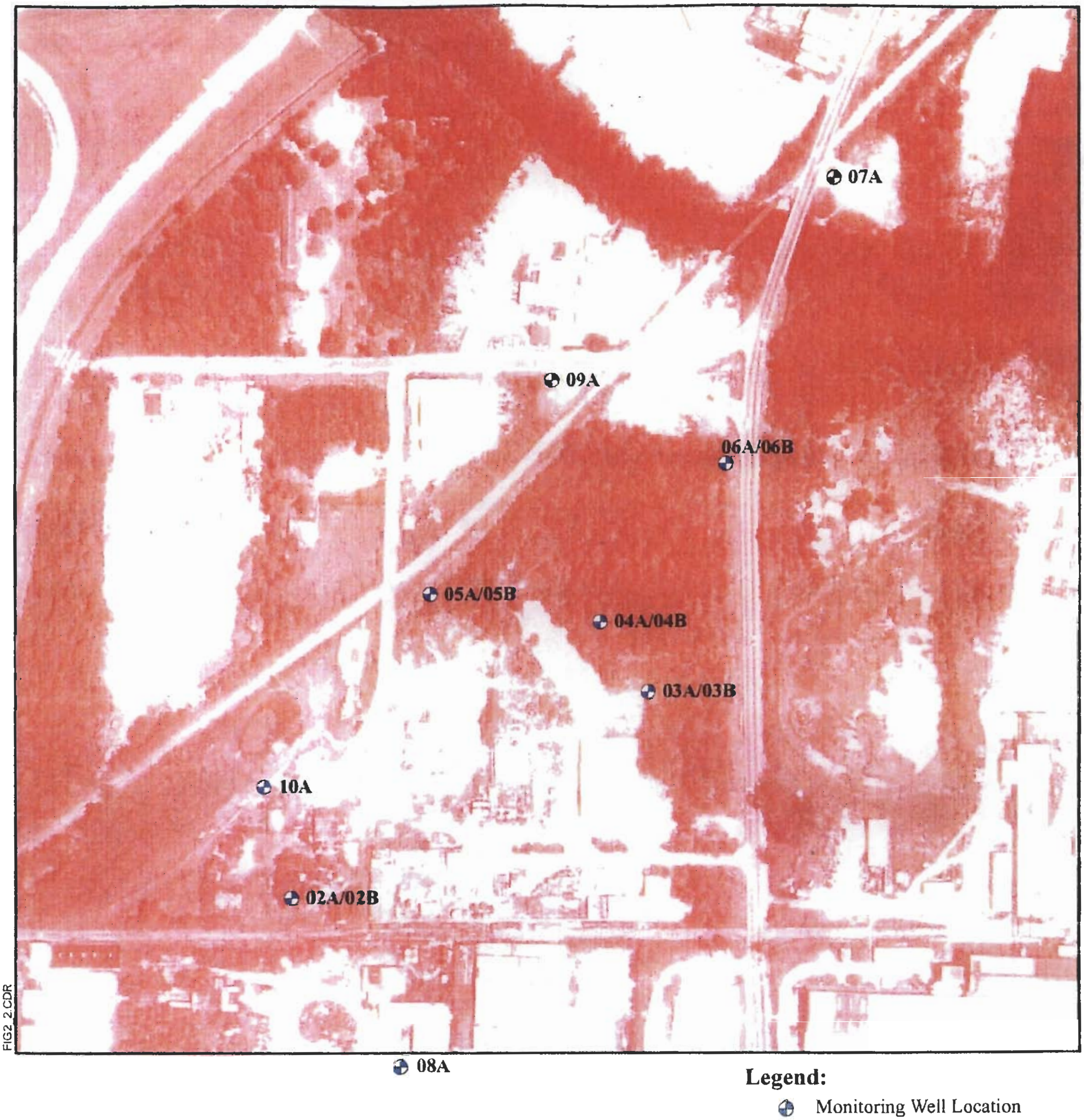
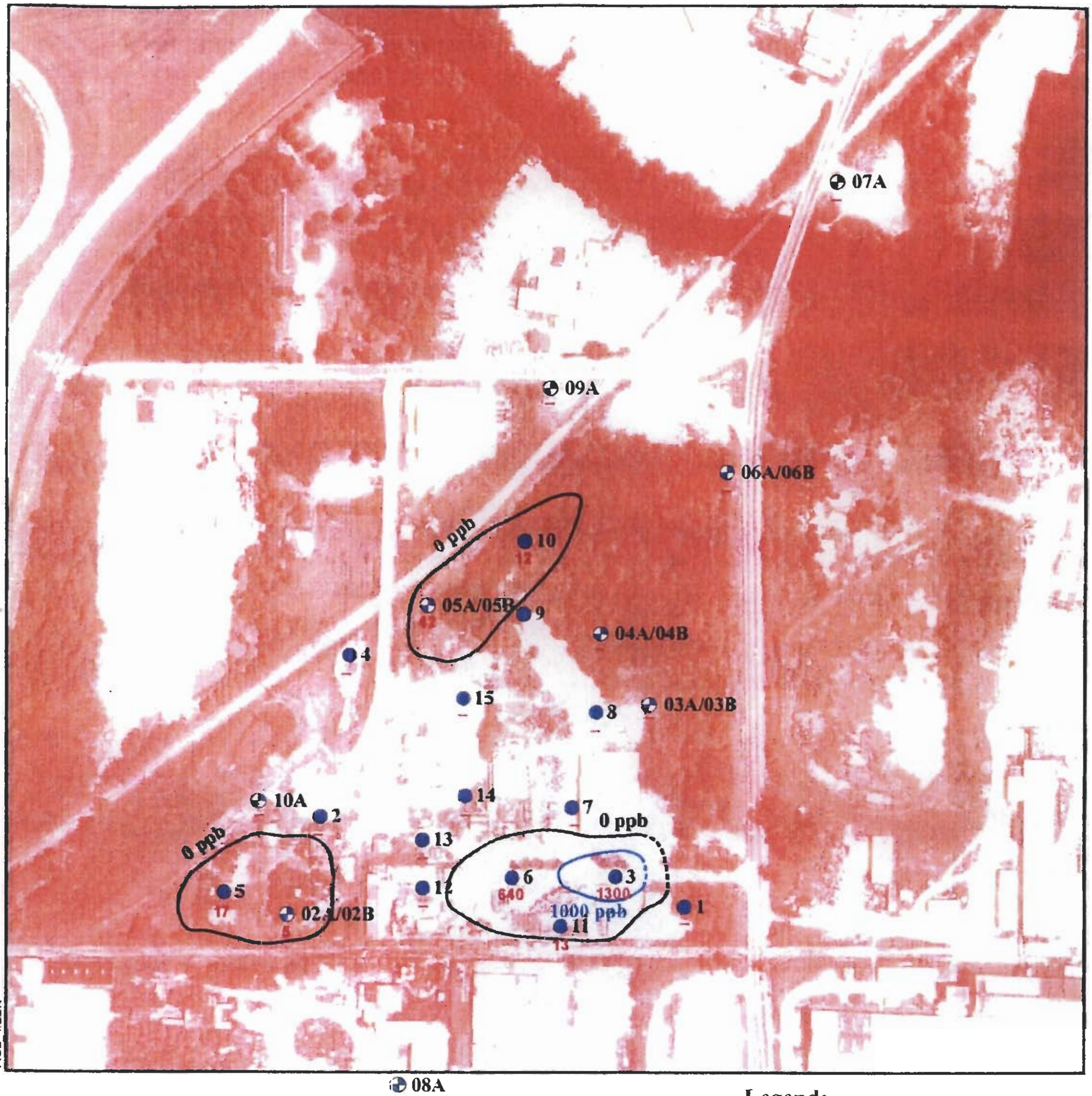


Figure 2-2

Monitoring Well Location Map
Supplemental Sampling Investigation
ChemFax, Inc.
Gulfport, Mississippi

EPA



Legend:

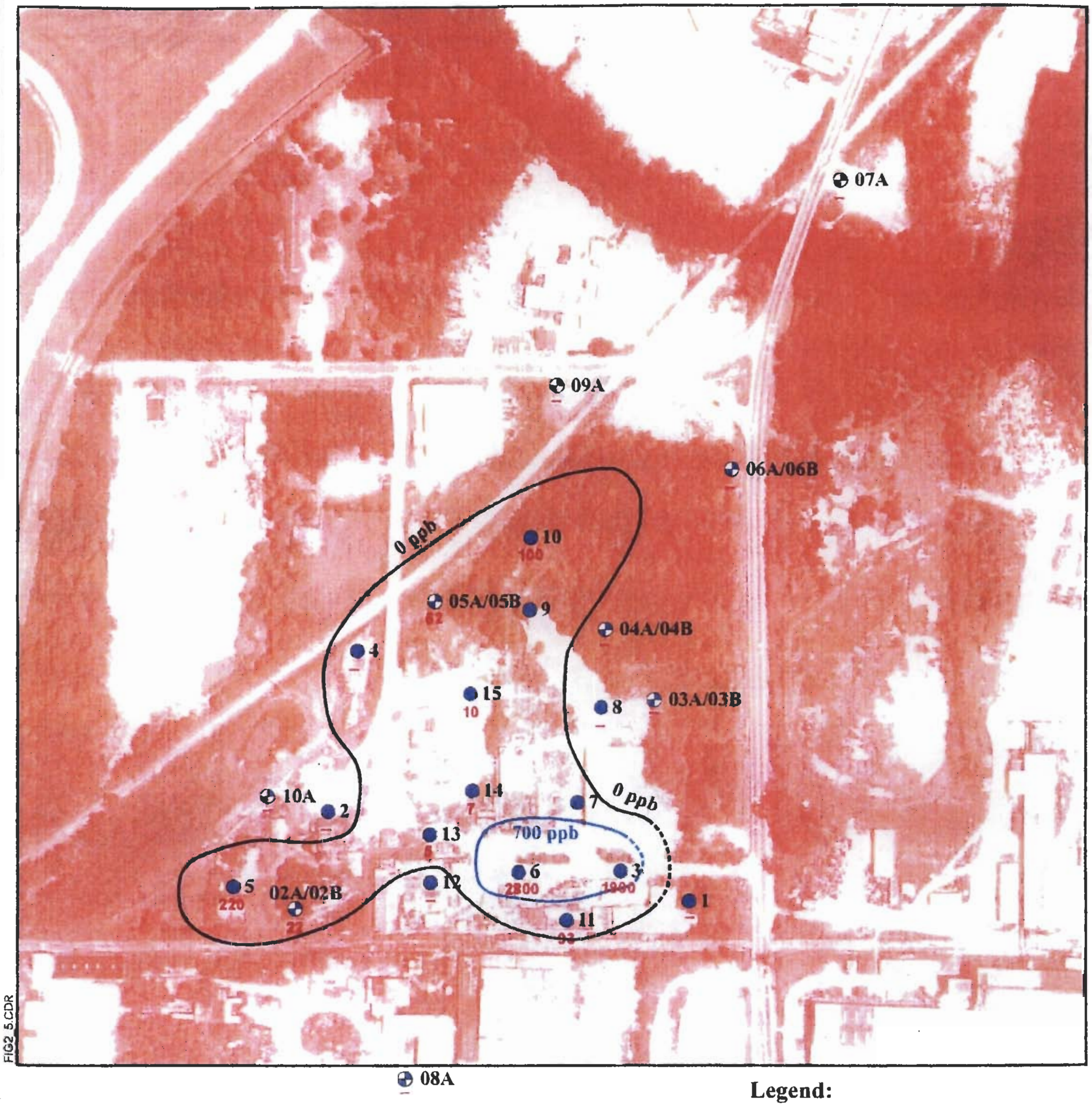
- GeoProbe Location
- Monitoring Well Location
- Area of detected Toluene concentrations ug/l
- 1000 ppb (MCL) boundary

All concentrations ug/l or ppb
Dashed lines are inferred boundaries

Figure 2-4

Toluene Contamination
Shallow Surficial Aquifer
Supplemental Sampling Investigation
ChemFax, Inc.
Gulfport, Mississippi

EPA



Legend:

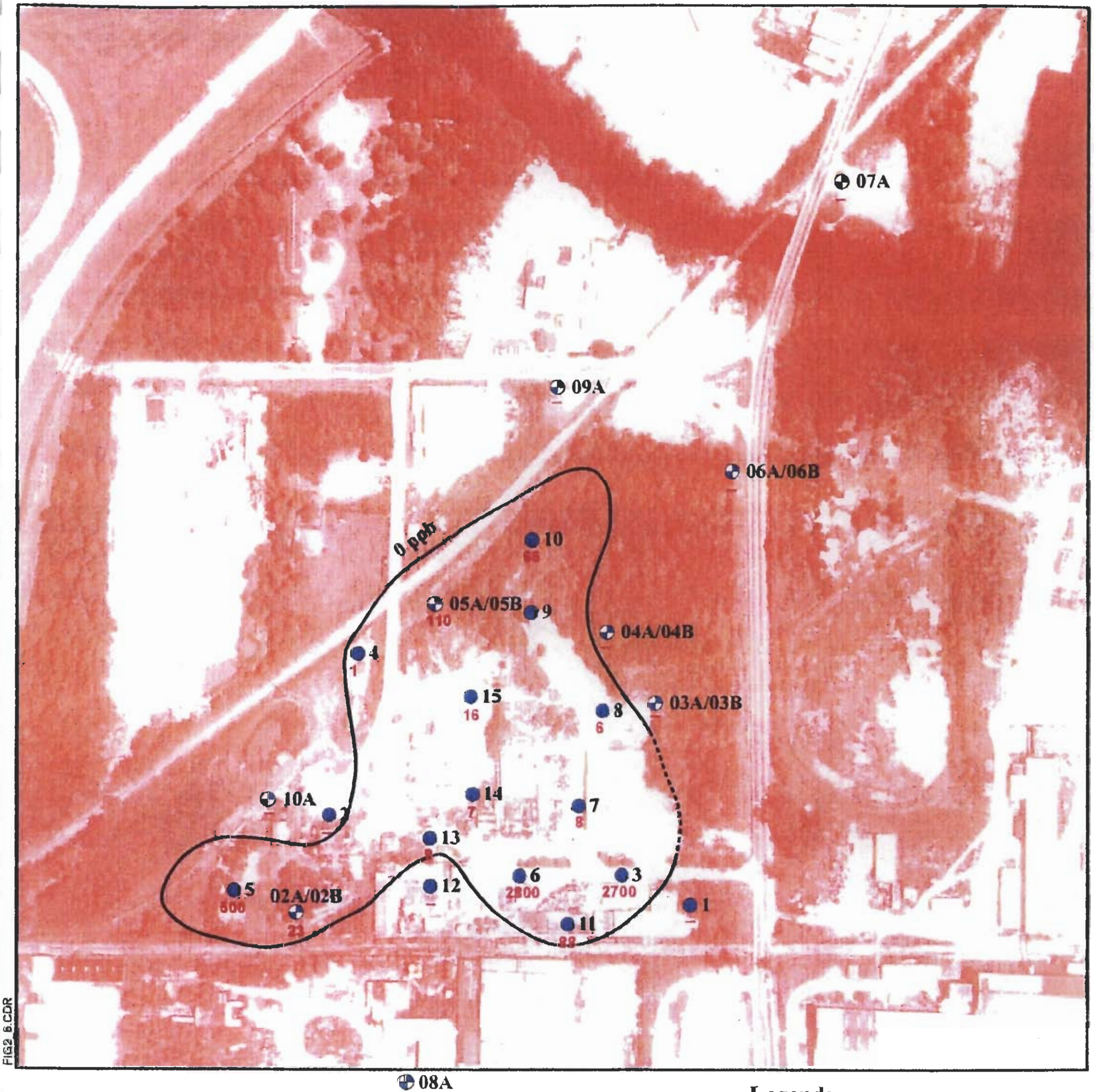
- GeoProbe Location
- Monitoring Well Location
- 0 ppb or non detect boundary
- 700 ppb (MCL) boundary

All concentrations ug/l or ppb
Dashed lines are inferred boundaries

Figure 2-5

Ethyl Benzene Contamination
Shallow Surficial Aquifer
Supplemental Sampling Investigation
ChemFax, Inc.
Gulfport, Mississippi

EPA



Legend:

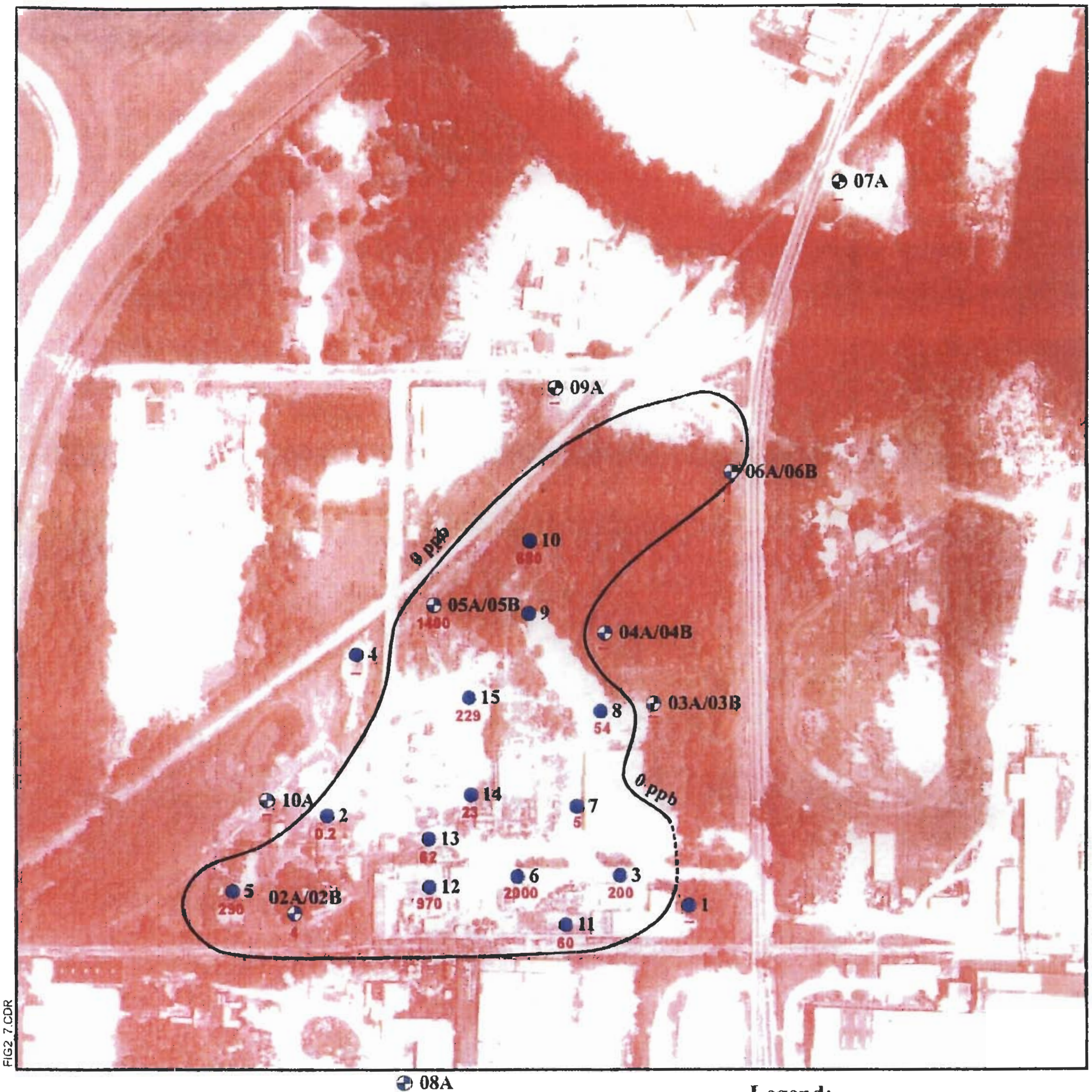
- GeoProbe Location
- Monitoring Well Location
- 0 ppb or non detect boundary

All concentrations ug/l or ppb
Dashed lines are inferred boundaries

Figure 2-6

Xylene Contamination
Shallow Surficial Aquifer
Supplemental Sampling Investigation
ChemFax, Inc.
Gulfport, Mississippi

EPA



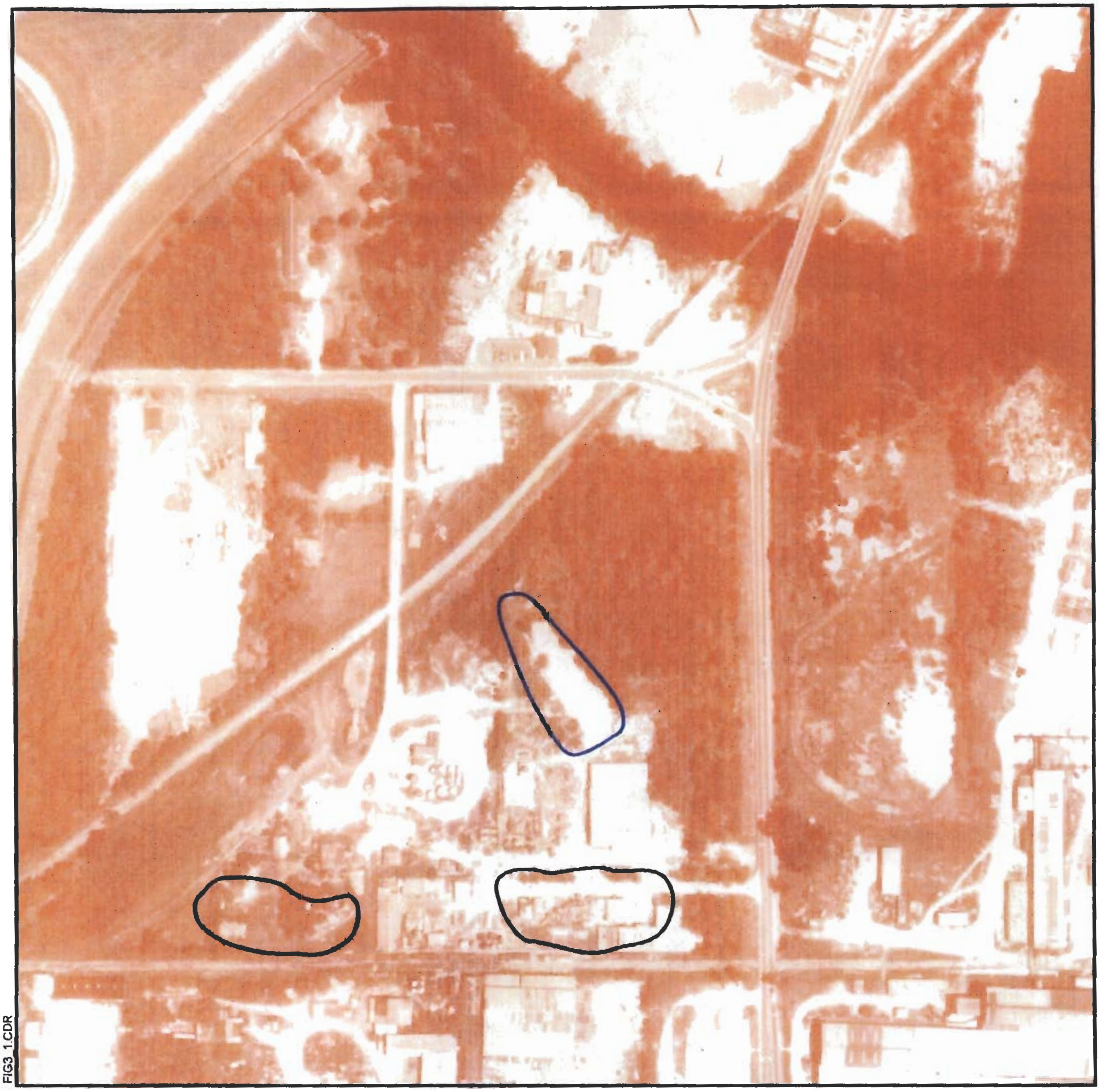
Legend:

- GeoProbe Location
- Monitoring Well Location
- 0 ppb or non detect boundary

All concentrations ug/l or ppb
Dashed lines are inferred boundar

Figure 2-7

Napthalene Contamination
Shallow Surficial Aquifer
Supplemental Sampling Investigation
ChemFax, Inc.
Gulfport, Mississippi



Legend:

Probable Sources of BTEX Contamination

Possible Sources of BTEX Contamination

Figure 3-1

Probable and Possible Sources
of BTEX Contamination
Supplemental Sampling Investigation
ChemFax, Inc.
Gulfport, Mississippi

EPA